International Journal for Electronic Crime Investigation

(IJECI)

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Digital Forensics Rcscarch and Service Center
Lahore Garrison University, Lahore, Pakistan.

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LGU International Journal for Electronic Crime Investigation
Volume 4(3) Year (2020)

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Research Article

Vol. 4 issue 3 Year 2020

To Combat White Collar Crimes In Public And Private Sector And Need For Strong Legislation And Ethics

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Abstract:

The paper deals with and investigates the requirement of resilient and strong legislation to combat white collar crimes, which are exponentially increasing with time both in public and private sector organizations. The influence of immoral and illegal practices in government, particularly the bribes of the highest order has paralyzed the normal functioning of the financial and legislative organizations. Bank frauds and cybercrimes are also increasing tremendously by employing digital devices and the internet. The purpose of this research is also to investigate the essence of the application of strong laws as well principles of morality and ethics. It is advocated by the authors of this paper that norms of morality and ethics on one hand impact a healthy effect on reducing such crimes but also enhances the productivity and profitability of the organizations in financial terms. Several modern organizations are incorporating and implementing the codes of ethics in professional practices. More strict must be the legislation and Code of Ethics, Ethics is the deterrence force to discourage the wrongdoings and adopting right approach so that honesty prevails and curses, crimes, offenses and sins can be minimized. There a serious need of introducing the social welfare system adopted in Europe, Canada and the USA. The bank employees are involved in Bank frauds and commit offenses of embezzlements and illegal transitions using the computer and other digital devices. The role of business ethics in the banking sector is of immense importance. The malpractices by some politicians must also be noticed with stern and iron hands.

Keywords: Online and digital Banking, White Collar Frauds, Business Ethics.

1. Introduction

Nowadays, due to depression in the economies of all countries, political instability and the spread of epidemic the Covid-19, there have been adverse behavior of human beings. Even before Covid-19, digital offenses, money laundering and illegal transactions were at their peak. The world is facing a great challenge to fight out such illegal professional practices. The business activities are also expanding and there is a need for fair transactional financial activities. According to [1], the major sources of illegalities occur due to mal-functional and deliberately stealing the amount from the accounts. Most of the

illegalities are committed using computerized software. The hacking of accounts and websites has become a frequent phenomenon. The offenders manage this with automated and expert systems to damage and spoil important and useful information of tractions and most of the time hack the identity of bank customers to cause financial harm to them.

According to [1], the following important points have been highlighted in this case:

a. Slack and deceitful behavior of worker and employees

b. Inefficiency, incompetence, immoral approach towards working,

c. Wilful negligence and malfunctioning in the business activities particularly while dealing with amounts receiving and onward transferring and money exchange locally and abroad.

d. Malpractices by private and industrial, commercial organizations and banks

e. Damaging the market through disinformation,

f. Defective auditing,

g. Deficiency of honest and trained bank officers.

Inaccurate 'trade data' is often purposefully floated to mislead and do harm by businesses to other business counterparts. Industry and trade indexes, statistical market conditions measures, comparative parameters of business statistics on which business volume, operation, credit availability, price patterns, benefit potential and investment opportunities rely are carelessly prepared because of ignorance, inexperience, or knowingly deceptive purpose.

According to [2], in lieu of high-speed processing facilities and technological assistance, automated bank frauds often create a bad name for the bank and suggests inefficient organizational conduct. Business ethics must, however, play a key role in the banking sector.

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2. White Collar Crimes

A crime is peculiar to a group of persons, usually in positions of influence that can be linked to them in their society through their social standing. White-collar crime refers to the nonviolent, politically motivated crime perpetrated by corporations and government professionals. It was first defined by the sociologist Edwin Sutherland in 1939 as "a crime committed by a person of respectability and high social status in the course of the occupation". For example, it is committed for financial gains, such as securities fraud, embezzlement, corporate fraud, and money laundering.

3. Identification Of Unethical Behaviour

Negligent behavior, fraudulent behavior, deviant behavior and moral dilemmas are common in the banking sector. Unethical norms in various functions of banking are observed, such as receiving, collecting, transferring, and paying, lending, dealing, investing, exchanging and servicing money

and money claims both domestically and internationally.

Private Banks, industrial, commercial, multistate, multipurpose banks and holding companies are often seen practicing unethical conduct in one way or the other. The private commercial banks working in credit to business and operations in the fields of "thrifts", savings and time deposits, mortgages, lending and dealing with consumer loans, personal loans and securities businesses also have been involved in well-known unethical practices. Commercial banks and the "thrifts" are affected by new products and services of development by securities firms including money market funds.

The trust companies and financial enterprises are also engaged in many kinds of illegal and unethical practices while transferring money at home and abroad, collection and exchanges while providing services as stock transfer agent at the time of bringing the buyer and the seller together as a travel agent.

Some other major restrictions and measures that are to be practiced in the practice are not adequately followed. Due to weak accounting practices and lost records, significant and severe mistakes are made in the banking industry. This leads to opportunities for fraud. Frauds also arise out of false declarations. Goods in transit may also be a source of fraud by certain companies. Some bank frauds are committed in collaboration with the auditors.

4.0 Most Unethical Practices, Bribe and Corruption

Bribe and Corruption are all around us in this era, in Police, courts, health, education, money landing from the public exchequer in public and private organizations. Universally known

corruption is that people have to pay a bribe for Public Services at the grass-roots level. The paying of bribes varies with respect to discretion and contact with consumers gives public employees the ability to claim bribes, the extraction of bribes varies according to industry, region and particular local circumstances. For contracts and permits worth vast amounts of money, the literature on corruption appears to concentrate on great corruption. However, to access public benefits, 1.6 billion persons annually have to pay a small bribe. These bribes decrease the efficacy of donor assistance designed to reduce hunger in developed countries. Acts such as replacing corrupt politicians with machines, encouraging more transparent governance, and allowing people a choice between service-providing entities will help eliminate bribery in service delivery.

According to [3], the literature on corruption tends to focus on great corruption in the case of contracts and permits worth large sums of money. However, 1.6 billion individuals have to pay a nominal bribe annually in order to obtain access to public benefits. These bribes decrease the impact of donor aid planned in developing countries to reduce poverty. Acts such as substituting computers for crooked officials, fostering more open government, and encouraging individuals to select between service-providing companies can help eradicate bribery in service delivery.

When public services such as health, education, and police are pursued, residents are most likely in touch with the government. People can need to pay petty bribes to get these facilities in countries with crooked public employees. Survey research showed that in order to get public benefits, 1.6 billion people annually have to pay a bribe. Petty bribery in developed countries will minimize the efficacy

of donor funding for poverty reduction programs. Reforms that will help minimize bribery of particular facilities are in progress. The political corruption is high in most evident in several countries [3] and very low in Japan about 1% and 77% in Liberia; Lithuania with a high level of bribery, 29% . However, the average among EU member states is 4%; it is just as low in the Anglo-American world.

The need for transparency has been discussed in [4]. According to [5[and [6], it is suggested that how to control them using the e-government technology in Bangladesh. The concept of mainstreaming has been presented in [7]. The articles [8], [9] and [10] describe the details of political corruption. Various reforms have been proposed to combat corruption. The articles discuss the anticorruption methodologies for implementation.

4.1. Bribe, Corruption and Political Culture

Political culture theorists predict that most people in cultures defined as oppressive by Western norms will consider bribery as the natural way of doing things. Surveys, however, regularly find that a vast majority agree that accepting a bribe is incorrect, while the minority that finds bribery appropriate does not account for the actual rate of corruption. People are willing to pay a bribe as a lesser evil where there is a discrepancy between an ethical reluctance to indulge in wrongdoing and the desire to look after the welfare of family members or care for the education of a child. People pay bribes as they are requested by elected authorities as a prerequisite.

4.2. Payment of Bribe to voters by politicians

A case has been recently highlighted in the press regarding payments of very heavy amounts of bribe to the potential voters in the Senate Elections. This incident occurred in 2018, but the videos appeared on social media and other TV channels of Pakistan, in February 2021. A prominent personality of a principal government has been involved.

The voters were also the member of a Provincial Assembly, who were receiving bribe money, in order to elect the members of Senate. It amounts to selling and purchasing the votes. In the video, it can be seen the politicians and legislators receiving the bribe. The impact of such incidents is extremely damaging for the country and its reputation.

The members elected in this manner are usually responsible for money laundering, inflation and financial frauds. There must be some administrative measures to implement strict laws to combat corruption and bribery. The significance, seriousness and importance of such offenses must be top priority of the federal and provisional governments, a useful survey has been presented in [14], giving the case study regarding Australia.

The public apprehensions and insights of white-collar crime have been discussed at great length in [15]. There is another interesting national public survey has been conducted and presented in [16] regarding white-collar crime. Crime intensity research is relevant because it has direct consequences about whether or not.

Table 1: Areas of White Collar Crime [17]

Credit Card	Counterfeiting	Insurance Trickery
Currency arrangement	Embezzlement	Investment Act to commit fraud
Kickback	Black Money	Income Tax avoidance

The public will support the use of criminal penalties against the unlawful use of white collars. The traditional view of the population as oblivious to such transgressions was underlying the People do not see white-collar crimes as serious, they say. By proving that this belief is based on the analysis of severity led to the finding that the study was empirically unfounded. The public wants that white-collar criminals to be prosecuted and punished as often or worse than other traditional street crimes for crimes with severe harm. The other serious duty of the government is to enhance its ability to properly prosecute and eliminate violence from the White Collar crimes. Though it is said there is normally no physical violence, but it is there in some cases. The well-known types of white-collar crime are corporate, state-corporate, occupational and governmental,

A central observation in recent literature is that both the American public and people are Other Western nations are very willing to prosecute criminals wearing any wrongdoing criminally. Necklace of color. With this basic policy dilemma settled, a new generation of research needs is expected to be undertaken. The previous section detailed the significance of concentrating on styles of White-collar crime and main moral values that could inflate or minimize public crime.

5. Role Of Ethics On White Collar Crimes

According to [1], economic theory and strategies are driven by behavioral assumptions. Based on actions, economic models are developed and tested; thus, principles, beliefs and economic growth go side by side. The whole set of individual behaviors, judgments, interpretations and behavioral habits was accepted by beliefs. The

foundation incorporate ethics is the truthfulness and trustworthiness of comments and acts. Continuing professional advancement requires expertise and study extension. The most common aspects of corporate ethics are Prevention of conflicts of interests, user, boss and institution loyalty, the risk to outsiders and the public. Major rises in theft and fraud are being committed on a wide and small scale owing to the digitalization of financial networks. Credit cards, money laundering, internal misappropriations, mobile banking, fake emails and misrepresentation of customers are linked to popular bank frauds.

Let us first explore the principles of 'good',' right' and 'obligation' in order to create an operationally viable framework for business ethics. These major variables revolve around the ultimate topic of moral philosophy. Then the questions arise: how can enjoyment be exercised? Should he practice it in a reasonable, neutral, judicial manner? Social concepts such as prudence, benevolence and equity are self-explanatory, while mathematical axioms and theorems do not imitate them, they are applicable to human actions (like mathematical formulas). Likewise, in the field of business ethics, considerations such as aesthetic assessments of objective validity and impartiality, good conscience (legally), humanity and social love build a disposition. Such ideal ideals, such as the importance of intelligence, tradition, intellectual activity, truthfulness, love of truth, purity, temperance and modesty, also have a major positive influence on functional ethics.

The Business Ethics is producing and enhancing productivity in the international and national organizations. The business leaders realize the relationship between morality ethics and corporate's advantages. In the marketcustomer, stakeholders, stockholders

and company's relations do have positive and fruitful impact on the business. The Ethics brings several advantages in the market, such as improved performance and workers are dedicated to their duty and reputation of the firm leads to more profitability. In their decision-making, companies and customers cite business policies and principles as prime factors. Superior performance of workers: Businesses with good management policies and defined principles report enhanced morale of staff, decreased recruitment of employees and increased efficiency. The reputation of a corporation will never recover until harmed by controversy or unethical conduct - resulting in decreased sales, reduced productivity of staff and heightened regulatory and media attention. Emphasizing prudent corporate behavior is the best way to protect the valuable assets of a business.

6. Ethics Of Islam

Trust and fear to Allah the Almighty is the binding power behind Business Ethics in Islam. "Every religion has distinctive virtue and Islam's distinctive virtue is modesty." In Islam, "Every good work is charity" (Hadith Mubarik), where the word "good" means what is recognized to be good, fit, decent, being, virtuous character, duty, goodness, rightful favor, bounty, and obedience to Allah. "Hazrat Amru Abbas" (91,2210}; "What is Islam?" asked the Prophet (PBUH). The prophet Muhammad wrote, "Purity of speech and hospitality." Peace be upon him. The course of world history was transformed by Islam through Prophet Muhammad Peace be upon the life. The deterent force in Islam is fear of Allah Almighty and the life hereinafter, which protect us not to commit sins and crime.

7. Conclusion And Recommendations:

1.   The government must take positive steps to reduce corruption and bribery. Overhauling of anti-corruption institutions must be accomplished. The utilization of public funds must not be allowed to plunder and wasted. Take stern action against the public servant to be placed under strict surveillance to combat Bribery and corruption.

2.   Computerization termed as e-commerce and e-governance must introduce in all public sector organizations. Reviewing reducing the regulations and making the procedure easier through applicable software will also boost the process. Special vigilance is required for services where millions of people are affected by bribes and corruption. Let the freedom of the press be restored so that they may launch the campaign against bribery and corruption.

3.   Old un-useful laws and regulations must be repealed and substituted by new stern legislation to combat the financing terrorism. Randomly application of discretionary powers is the actual cause in such actions, therefore, these powers must be abridged, curtailed and reduced, and let the officers work according to law, Rules and Regulations. By electronic means, track elected authorities. Encourage the use of social media to condemn corruption and ransom requests on particular services. Let public expenditures comply with citizen entitlements.

4.   In the area of business ethics, economics and morals, comprehensive programs can be planned and developed for bankers during training at banking institutes. In-house ethics activities, conferences, seminars and short-term training in ethical philosophy related to banking and employee advice must also be created. In

order to organize moral education, all meaningful actions should be taken.

5. Try to amend legal and ethical standards in terms of moral principles by incorporating improvements to current codes. The survival of the fittest is the spirit of the banking industry, technical advice, experience, skills and business expertise are passed and banking management remains fit. Policymakers and clients are professional, ingenious, educated and knowledgeable while working with workers. The laws must be based on and drawn from a defensible moral theory that takes into account market dynamics.

6. It is important to hire citizens with good faith and ordinary conscientiousness so that they embrace with honesty the codes and concepts. Public officials must be able to benefit from the support of intellectuals from outside the profession in question.

7. If a person has been wrongfully permitted to join as an employee, management must have the right to discharge the misfit if it is not to contribute successfully to the accomplishment of pre-settled goals. Employee competency, behavior, preparation and expertise requirements should be favored over political pressure for appointments in the banking sector, especially for technical personnel.

8. Many banking sector companies have provisions that forbid workers from receiving gifts, ensuring that consumers are not placed in an uncomfortable situation by breaking corporate policy. Because of the benefit that is given and nothing more, a customer can use the services. Steps to restore conventional principles should be taken to inject trust and honesty into banking industry practices and partnerships to build profitable relationships with staff, clients.

9. Measures should be taken to eradicate unethical norms and malpractices for bridge financing. It is a short-term financial arrangement given to the industrialists for their projects and recoverable from the sales of products. For this purpose, political bribe, discretion and element of exemptions work.

10. Discretions and illegal exemptions are killers of every system. The unlimited discretionary and exemptionary powers lead to unethical norms. Lacunas in the policies, which keep the policies-unimplemented and ultimately the circle of exemptions and discretion create a vicious circle of corruption.

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Research Article

Forensic Examination and Identification of Writing Inks on Documents

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Abstract:

Ink analysis plays a significant role in questioned document examination, a discipline of forensic science. Writing inks based on their chemical substances such as solvents, resins, colorants as dyes or pigments, may be distinguished by applying two step methodology including non-destructive or visual examination and destructive or chemical analysis. Both approaches involve identification and comparison techniques by contributing certain advantages to the investigation such as Thin Layer Chromatography has been marked for a long time. However, forensic scientists have the availability of evolutionary methods that led to the use of less destructive techniques including spectroscopy that minimizes the scope of previous separation techniques. This review paper delivers an outline of techniques/methods including spectroscopic and chromatographic development with possible advantages or drawbacks. The acquired results should be evaluated accurately by paying more consideration as providing reliable findings in the court of law is certainly of central significance.

Keywords: Writing Inks, Visual Examination, Chemical Techniques, Instrumental Analysis, Dating Inks.

1. Introduction

Documents are essential part of our lives that accompany us in a number of ways from birth to death certificates. It records everything we do throughout life in the form of letters, personal diaries, receipts, wills, identity documents, bank checks, insurance agreements, promissory notes, loans, leases, bonds/deals, tax returns and testimonies etc. [1,2]. Forensic examination of these documents is important as their validity is often questioned during legal proceedings. Crimes committed with documents are more prevalent with greater influence on society and comprise billions of dollars as compared to any other violent crimes. For example media and news reporters/journalists report homicides, sexual assaults, kidnappings/abduction, fires, blasts, and other violent acts [1]. The current progress in the process of digitalization has established significant modifications in way of exchanging information and replaced traditional means of documents. Nevertheless, there are many cases where conventional methods of transactions or agreements are still practiced involving ink application [2]. Therefore, forensic examination of ink on

writing documents either a typed, printed or handwritten is being applied in a number of civil and criminal investigations.

Forensic examination of ink is a principal piece of investigative and legal cases related to forgeries, counterfeits, ransom notes or threat letter etc. [3]. Forgery involves fabrication and falsification of documents that causes alterations or modifications to an original documents and creates a false document from scratch of existing sample respectively [2]. These fabricated and falsified items include writing materials such as writing ink and paper, laser printer and photocopy toners, typewriter and printer inks, and correction fluids. Writing inks are the most valuable of these materials and are a mixture of composite components that provide preferred appearance, thickness and drying dynamics, and other properties based on different writing instruments [1,2]. Such as fountain pen inks are water based, ballpoint pen inks are based on dyes and organic solvents giving them oil consistency, and rollerball pens use gel inks based on water vehicles with dispersed pigments. However, all of these writing inks irrespective of instrument types, work as crime tools [2].

In questioned document, the main purpose of ink analysis is to isolate or identify the source of ink used on writing documents, comparing two or more ink entries and dating process of ink entry. Here the source could be a particular brand or class of concern writing tool or specific manufacturer batch/year of questioned ink entry [2,3]. The source identification process of an ink sample can be obtained by comparing it directly against specific/known writing or writing instrument involved. For some intelligence based cases, information related to ink manufacturer is collected by comparing ink samples to an ink

library/database or control samples. The result interpretation of these comparisons, is influenced by the similar characteristics of inks available in the market [3,4]. Dating of ink has progressed since its first development and now not only it is possible to determine the first manufacturer date of an ink sample but also determines the date when an ink was written on a document in questioned [1,3].

Two step identification process is applied that can be accomplished by conducting preliminary examination prior to chemical analysis that involves optical and visual examination of ink based on its composition like solvents, colorants, additives or resins. The optical and visual properties of an ink sample may be evaluated by examining its responses towards UV, VIS or IR spectrum. However, detailed chemical analysis is required as preliminary examination is typically not enough to answer the queries from judiciary panel. Chemical examination/analysis consists of destructive and non-destructive methods, of which non-destructive methods from a forensic perspective are more often performed as the given evidence sample remains intact and available for further characterization. It is not possible to identify all the components of ink sample thoroughly due to screening characteristics of forensic examination of ink evidence. The results of physiochemical examination are compared for both suspect and reference ink samples instead of identifying individual component. According to Neumann and Genessay, it is not always feasible to link association between ink and suspected manufacturers of writing instruments as the same ink procedures during their production are supplied to many different manufacturers. Thus, leaving a substantial impact on methodical practice, more specifically method that estimates the evidential assessment of

findings. Other factors include unstable entry of ink composition and ink degradation deposited on paper as a result of aging processes triggered by environmental conditions [2].

Ink examination is routinely used by local law enforcement agencies for criminal investigations as well as by lawyers in private sector to date disputed documents relevant to civil cases. For example, altered wills, disputed patents, medical negligence, divorces, tax and stock frauds, insurance schemes, copyright case, and a wide range of other contractual disputes etc. [1,3]. A Society of Forensic Ink Analysts, the SOFIA, was established in August, 1997 in the state of Virginia for the progress of forensic science discipline and methods in identification, comparison and dating of writing inks on questioned documents. The purpose of this organization is to set standards for executing these examinations associated with criminal and civil investigations. The establishment of this society led to better understanding of paper effects on writing ink and dating ink methods, and validation of these methods among the ink chemists and private examiners [1].

2. Ink Examination

Forensic ink analysis is considered as a specified part of forensic questioned document examination as it covers much of the documents involved in number of analysis categories. Therefore, resulting in particular instances where ink analysis is performed distinctly from questioned documents. Such as dealing with murder and criminal cases where threats have been written on walls instead of documents/paper. The inks from these writings are compared with writing evidences provided as known source markers of respective case [1]. Sometimes during an ink examination, it

becomes required to identify a particular writing instrument/pen and differentiate between the two inks applied on one document if they are same. Additional changes either long passages or a single digit in the form of writing can prominently alter or modify the sense of words or numbers regarded as money. Sufficient amount of ink is available during manufacture and development process of inks and pens for quality control tests. Whereas, in a forensic document examination ink analysis is performed on a minute quantity of ink wrote on a paper [5]. Therefore, when it comes to the handling of forensic ink evidence, it is preferred that the examiner must be familiar with the field and not to damage the document in questioned [1,5]. Field awareness and advance training will reduce the problems that may arise from semi-destructive property of many inks during analysis process [1].

To analyze and investigate ink evidence, the examiner should identify possible source of ink sample and its general chemical composition. Ink is a notable liquid or paste with different colors developed for writing, printing and drawing purposes. Anciently ink has originated and influenced from many civilization, contributing to our society for the spread of writing and printing knowledge [1]. Writing inks are composed of many functional types of ingredients commonly organic compounds. The key ingredients of inks are dyes or pigments or coloring agents, the device or vehicle to apply ink and the additives that regulate pH, polymerization and viscosity, and to avoid pen blockage. Other components included are solvents, lubricates, resins, biocides, corrosion inhibitors, surfactants, buffers and emulsifying agents formulated from a range of natural and artificial products either organic or in organic. Inks and their chemical composition can be classified based on basis of pen types including liquid,

aqueous, paste or powder. Other basis of classification is it's end use that includes writing and printing inks as two main classes [1,6]. Some of the inks with related substance encountered in forensic examination include ballpoint pen ink, roller ball pen ink, fiber tip pen ink, marker ink, fountain pen ink, gel pen ink, porous tip pen ink, plastic tip pen ink, pencil, rubber stamp ink, ink jet printer ink, letterpress ink, typewriter ink, and copier toner [1].

Other aspects of ink examination involve coordination with forensic handwriting comparisons for the purpose of identifying or eliminating a writer and coordination with latent print examination. Writer elimination or identification is most revealing as it involves analysis of original or an unaltered questioned document. Therefore, ink samples should not be removed from a document before any required handwriting comparison. For example, there is consequence of a conflict if ink sample is removed from the line intersections as these sites have greater quantity of ink with sequence of application regarding handwriting analysis. As a result, this determination becomes impossible because of ink removal from such positions. Similarly, heavy ink deposition site is gooping on an ink line of ballpoint as result of debris or blots on the tip of pen, which indicates the pen movement direction. This aspect of examination can be hindered if these sites are removed prior to handwriting comparison.

Another concern related to questioned document is preservation of its readability. During ink analysis the examiners who work for civil litigation, defense or criminal cases, if remove large section of the line from written samples, they may compromise not only the handwriting comparison but also make the entries unreadable on a document. Doing so

will leave photographic record as only means of evidence. Consequently, in order to assure the evidentiary value of a document, the analyst should seek advice from a forensic document examiner and case attorney prior to ink sampling if handwriting comparison is required. Furthermore, to process a document chemically for latent prints, ink sample should be removed to avoid contamination with developing reagents of latent prints such as ninhydrin and ink dissolution on the page by reagent solvents [1]. Therefore, techniques those give more information from the ink using either visual or nondestructive ways are applied at first and then those involving samples removal from the documents or destructive/chemical methods [5] as described below.

3. Preliminary Or Visual Examination / Non-destructive Methods

Preliminary examinations of ink evidence are those methods that can be performed quite quickly prior to chemical/instrumental analysis. These methods are nondestructive in nature as there is no removal of ink from evidence sample thus maintaining integrity of questioned document. Furthermore, preliminary methods do not require any costly instrumental procedures and provide result analysis without causing any serious issues [2] as follows;

3.1. Pen Line Microscopy

Human eye is reflected as a dominant scientific tool with proficiency to find out the facts from inspection of ink line on a paper. Addition of a microscope with low power magnification may give vital information from the appearance of a written line [5,13]. This information can include general chemical composition of an

ink, useful methods of ink identification and differentiation, and assessment of two samples either with same origin or same pen. Normally stereo microscopy up to 60X magnification with reflected illumination reveals the type of writing instrument from pen line features [1,5&10]. Following microscopic features of pen inks with related substances can be used to identify their sources;

- **Ballpoint Pen Ink:** ballpoint ink line provides a clear sign of its origin under a magnification of 20-50X. It has a unique pasty texture and distinct glossy appearance due to its partial absorption into the paper. There are many cases where apparent imperfection or dirty ball casing cause striations with removal of ink as ball rotates in casing [5,10].

Striations: are fine un-inked bands within the line of ink that spread from inside to outside of the line curve in the path of pen movement [1] as shown in following figure;
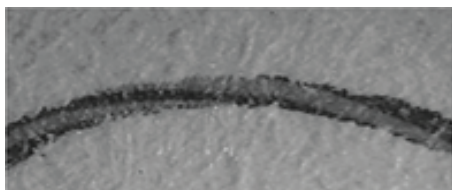

Figure 1: Ballpoint Striation 40x [1].

Writing Grooves: While writing with ballpoint, extra pressure is required during writing that can cause indentations or furrow as writing grooves in the paper as in following figure;
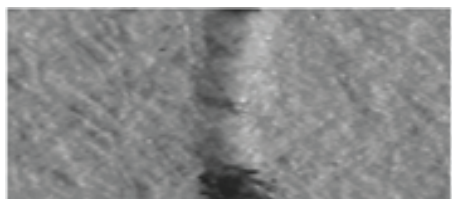

Figure 2: Writing groove 40x [1].

Gooping: Ballpoint has the tendency to deposit extra amount of ink in the line as the pen turns a corner, resulting in gooping as shown in following figure;

Figure 3: Ballpoint gooping 40x [1].

Fiber Diffusion: However, ballpoint ink does not show fiber diffusion or shading as compared to water based ink or wet inks that color the paper in a narrow line by absorbing into the paper fiber. In fiber diffusion, wet color absorbed in the paper does not show any layer but it evenly colors the surface area [5,10].

- **Roller Ball Pen Ink:** writing with roller ball pen ink dose not form striations or gooping but there may be sign of fiber diffusion. There is presence of more shallow writing groove as compared to that of ballpoint.

- **Fiber Tipped Pen Ink:** the stylus of fiber tipped pen as compared to ballpoint pen is made up of compressed fibers that are not hard enough in texture to form writing grooves. Fibers forming stylus bundle may cause striation within ink line due to splitting or forming fine lines with the main ink line because of usage fray as shown in figure 4. There may be presence of fiber diffusion as the ink used is water based [1,18].
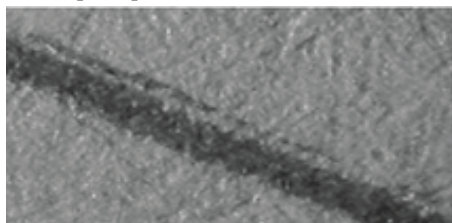
Figure 4: Fiber-tip pen striation/fiber bundle split 40x [1].

- **Felt Tipped Pen Ink:** similar to fiber tipped pen, the stylus is incapable of forming writing grooves as it is made up of soft or compressed material. It exhibits fiber diffusion as ink used is either water based or organic solvents as shown in following figure;
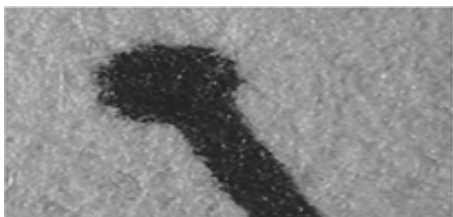
Figure 5: Fiber diffusion/felt-tip pen 40x [1].

- **Fountain Pen Ink:** this uses nib point thus producing dual nib marks or pathways based on the tip roundness, nib hardness or pressure exerted. It normally uses water based ink that results in fiber diffusion formation. Stroke shading with up and down pathways is a unique feature of the hard tipped fountain pens as shown in figure 6. There is considerable variation in the ink line near the pen pressure point where the nibs separate. With horizontal movement, pen line narrows followed by darkening of the line at the end because of the back flow of ink.
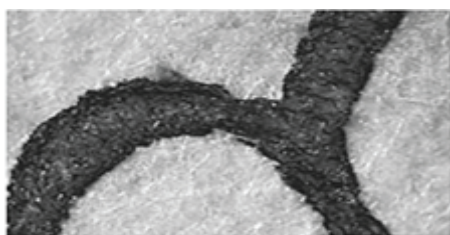
Figure 6: Fountain pen nib tracks/shading 40x[1].

- **Porous Tip Pen Ink:** it forms writing grooves due to hard feature of stylus with open tip and fiber diffusion using water based ink.

- **Gel Pen Ink:** gel pen similar to roller ball or ballpoint pen, uses a ball and casing. There is no gooping or striation formation in the ink line but is stable and dark in color. Most of the writers lower the pressure point due to smooth writing of the pen that intern reduces groove production. However, applying heavy pressure without any pen defect, sometimes may leave light inked portion at the center of the ink line like that of fountain pen. Gel pen ink can be effortlessly notable from fountain pen ink by showing single ball pathway or track under microscopic examination as shown in following figure;
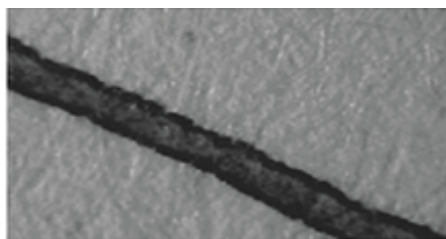
Figure 7: Gel-pen ink line (40x)

3.2. Microscopy of Non Pen Inks and Relevant Materials

Inks used to write other than pen are of graphic images or fonts that can be distinguished by microscopic features and usage on documents is a link to their origin such as followings;

- Typewriter Ink: ink used in cloth ribbon typewriter is deposited on the paper by impression device such as type font or pin of dot matrix printer. The ink can be distinguished microscopically as the carbon ribbon gives impressions with dull and less defined edges whereas the ink impressions from dot matrix are sharped. This can be useful for the examiner to

detect the ribbon that produced such impressions as shown in following figure;
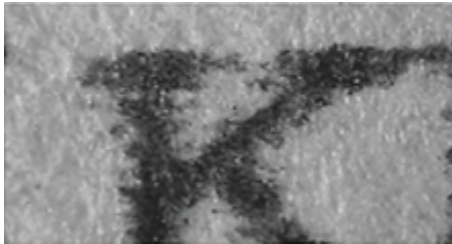
Figure 8. Cloth ribbon typewriter impression 40x [1].

- Rubber Stamp Ink: this type of ink usually red or black deposited by a rubber or polymer plastic printing surface on a document, can be recognized by faulty alignment of numbers, signature or notation. The sign of indentation is not likely and the surface area may be inked unconsciously.

- Offset Printing Ink: offset ink can be in the form of any color either high quality printing material or mass produced. The absence of toner spatter and sharp edges, distinguish it microscopically from a copier or printer origin device as shown in figure 9 where lines are produced by evenly spaced dots.
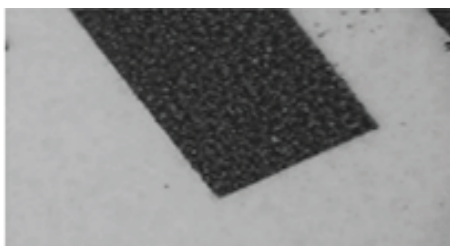
Figure 9. Offset printing 40x [1].

- Inkjet Printer Ink: this type of ink can be produced as a black or multicolored images onto a paper in the form of microscopically visible irregular shaped dots. There can be seen some color

spatters around the image area and fiber diffusion on uncoated paper. Handwriting images similar to original handwritings performed with liquid ink pen, can be printed from graphic files by using high resolution printers based on fiber diffusion.
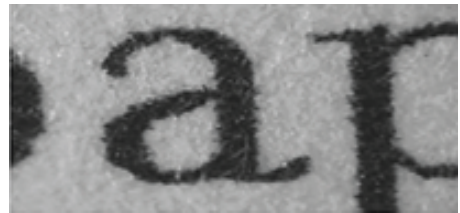
Figure 10. Inkjet printer ink 40x [1].

- Laser or Copier Printer Toner: resin coated and heat fused pigments are used to form an image on paper surface. Liquid toner colors the paper fiber following fiber diffusion characteristics whereas dry tone formulates unconnected granules. Color printers and copiers may show microscopic striation on large solid colored areas.

- Dye Pack: it is a dye or stain that in combination with exploding device is used for marking the stolen currency. Normally it is noticed on suspected currency as red ink spatter.

- Pencil: pencil and crayons are non-ink writing instruments that can leave distinctive microscopic traces in the form of solid deposits on the paper. Graphite and crayons are distinct from other materials because of their shiny appearance and waxy look, respectively. Impression from carbon paper may cause problems but it produces regular shading from the edges by lowering the pressure away from the center of the line, which distincts them from sharp edges directly made on the paper [1,5].

3.3. Color Assessment of Ink

The color difference is the main source between a questioned ink entry and a known writing on a paper and is one of the initials steps to be performed after determining the two ink samples were produced either with the same or different writing instrument. The three main elements of color assessment of ink are the ink sample, light source and observer [1]. The colors of dye and pigment that we view are either actual reflection of color materials or they are color additives which are produced by adding various reflected colors [1,5]. Such materials absorb light at specific wavelengths as they have combinations of atoms in their structure known as chromophors that exhibit the property of absorbing range of wavelengths. For example, some components of white light are absorbed such as green, blue and yellow, while the red is not absorbed so it will reflect as red color. In the same way, any object will be appeared as black if all of its spectrum is absorbed [1].

The combination of reflected wavelengths can be mixed by the eye that leads to identical appearance of the reflected light source with two different absorption pattern. For example, green color can be produced by reflection of two different dye source as green or mixture of yellow and blue dyes. Consequently, two inks with similar look but with different dyes and absorption pattern is not an indication of same origin or source. So methods are developed to distinguish these differences. The simplest method involves the use of any color light other than white on both inks. The differences will be detected if those portions of colored light reflected with different appearance to the eye [10,12].

Another method uses dichroic filter to detect differences in the spectrum by combining two colored glass or gelatin filters bonded together such as red and green filters. Light must pass through both filters and is partly absorbed based of absorption spectrum of two combined filters. At certain wavelengths, light transmitted will be consisting of small windows. A particular color will be visible if it is reflected with same wavelength as that of window. An absorption difference will be detected at this wavelength of two inks with similar appearance. Special equipment is used to determine absorption curve. Micro spectrophotometer is used to overcome the problem of small availability of material in ink lines. This is not used as common method due to expense and complexity [10,15].

3.4. Ultraviolet and Infrared Radiation

Ultraviolet and infrared radiations are invisible but these are absorbed similar to visible light. Absorption and reflectance of most black and blue inks can be examined as they absorb ultraviolet. On the other hand, most of the inks with similar color, absorb visible light and some differ with infrared absorption [1,5] as shown in figure 11. Infrared absorption depends on the chromophors and absorption range may vary from visible light to near infrared range. This variation will not affect the color of the ink as infrared invisible. Hence, an ink may continue to absorb radiation from the red to the infrared or will pass through it or will reflect as invisible or transparent light. Infrared radiation ranges wavelengths from 700nm to 1000nm where it is used to detect document examination and extends beyond this range where it becomes source of identifying chemical compounds [5,8].
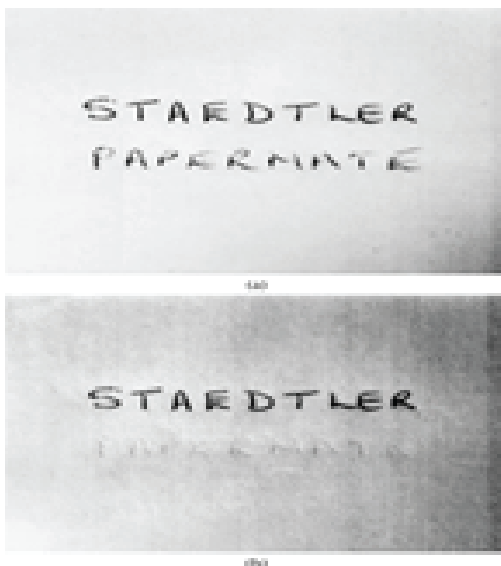
Figure 11: Two black inks of different manufacture photographed in (a) normal light and (b) infrared radiation, showing the difference of absorption in the infrared region [5].

Infrared is detected by using photography, emulsions or electronic means like photoelectric cells on display unit. Photography method uses infrared sensitive film and appropriate filters that are placed over the lens to allow only suitable wavelengths of radiation to pass through it. This method is used to obtain good quality of photographs which later on improved by introducing image converters and infrared sensitive tubes with suitable filters and light sources [1,8]. These mechanisms were followed by Foster and Freeman Ltd to make a purpose built apparatus Video Spectral Comparator (VSC) combined with filters, light sources, visual display unit, sensitive tubes and lenses. VSC enables to carry out a wide range of examinations under an ideal condition. VSC was further modified and other manufacturers developed similar apparatuses such as Projectina AG of CH-9435 Heerburgg made the Docucenter. It was combined with enhanced image techniques, improved light sources and video printers that facilitates instant recording of the screen of the monitor [8,14].

VSC and similar devices detect the differences between the inks with components absorbable in infrared range at a certain wavelength where one ink disappears and the other remains visible. Care must be taken as a thicker or more intense line of the same ink under similar conditions may show more prominently than the weaker one [14]. In addition to ink comparisons, infrared also detects graphite that constitutes to a large portion of pencil lead, and is absorbable in all ranges of infrared and visible spectrum. For instance, graphite is easily detected in a simulated signature where an ink if written over the signature made by the pencil line, is transparent in all spectrum of infrared radiation. [1,5].

3.4.1. Ultraviolet Fluorescence

Questioned document materials such as paper, glues, sealing waxes and adhesive tapes produce specific ultraviolet fluorescence that is excited in invisible region by ultraviolet radiation and is used as a source of identifying similarities or differences [15]. Chemicals or solvents applied to papers when dried apparently leave no trace but cause changes to the fluorescence that can be observed under ultraviolet radiation. Thus, erased writing can be revealed under ultraviolet examination. In the same way, inks can be distinguished from one another if having similar appearance such as red inks under ultraviolet radiation fluoresce. Inks differences have been reported through the production of fluorescence from lower wavelength to higher wavelength of ultraviolet region [5]. Ultraviolet fluorescence was more useful in past as evidence from older ink formulations were more detectable by this

method. But today's dye based inks are more detectable by infrared luminescence. However, visibility of some modern inks are projected only to ultraviolet radiation. Some inks are invisible when used to write on various documents such as signatures for security reasons but these inks are rarely involved in laboratory examination [8.11].

3.4.2. Infrared Luminescence

Infrared luminescence refers to emissions by papers, inks and erased ink leftovers in the visible infrared region in longer wavelength as shown in figure 13. Like ultraviolet radiation, infrared luminescence also uses photographic or electronic devices for direct vision [1,5]. To have a detectable result, high intensity of luminescence is excited by providing suitable sources such as quartz iodine or tungsten filament or xenon arc lamps combined with copper sulfate saturated solution or glass or gelatin filters. These allow passing of the green-blue exciting radiations as illumination but prevent falling of infrared from the source on the document. During this illumination, both the green-blue light and infrared luminescence emission will be reflected by the document so another filter is required to reduce exciting light coming from the detecting source of luminescence [7].
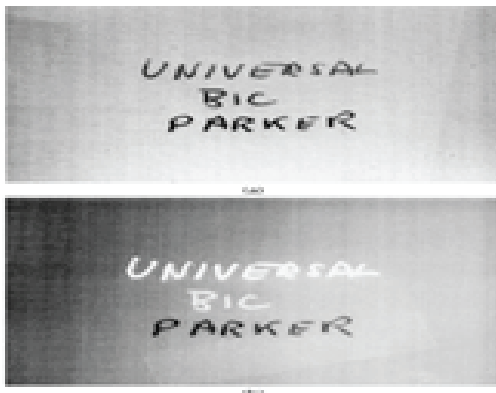
Figure 13: Three blue inks of different

manufacture photographed in (a) normal light and (b) conditions suitable for the excitation and detection of infrared luminescence [5].

Photography or video camera like VSC with range of filters are used to detect the luminescence from different inks with recorded results on a video printer. Laser light is used as an extension of green-blue light to excite the luminescence radiation. As it is intense and monochromatic so does not require to filter out unwanted radiation. Therefore, visible luminescence closer to exciting light wavelength can be detected by cutting out the laser wavelength through filters. [9,16].

Other effects of luminescence under laser radiation include the observation of ink components printed from one page onto the adjacent page that has been in contact. The printed part of the ink is not obvious but its effect can be detected under laser light. Similarly, transparent plastics especially designed for wallets have the tendency to absorb and show impressions from ink traces or paints of details on the credit cards that have been in contact. Furthermore, fluorescent traces of vehicle index number written on a hand and then washed off, have been detected hours later under laser light. It is also possible to detect finger prints if they are contaminated with fluorescent materials [1,5&21].

3.4.3. Ink Erasures and Obliterations

Possible traces of invisible inks on or below the surface whose color components have been removed, when illuminated with visible light may fluoresce or luminesce. Detection methods are sensitive and can be affected by weak fluorescence or greater luminescence of paper than ink traces. Therefore, erased area must be observed in all possible wavelengths

as it is not always evident that what components of ink penetrate onto the surface more deeply when drying on the paper [5,9]. Infrared luminescence can be useful in detection of typewriter ribbon, stamp and pad ink erasures but not possible in some cases where all inks will not give a luminescence trace. [7,9].

In case of obliteration, original writing can be detected by examining the obliterated entries either of similar or different ink color under infrared radiation only when the original writing absorbs the infrared radiation. This technique will be of no use if both ink entries react to infrared radiation. However, this problem can be solved if the original ink absorbs infrared luminescence and will be visible under the non-luminescent obliterating ink. On contrary, if the obliterating ink fluoresce and the original ink absorbs infrared luminescence by reducing the luminescence of the covering ink so a dark area equivalent to obliterated area will be apparent [1]as shown in figure 14. It is required to control the lighting and filtering conditions.
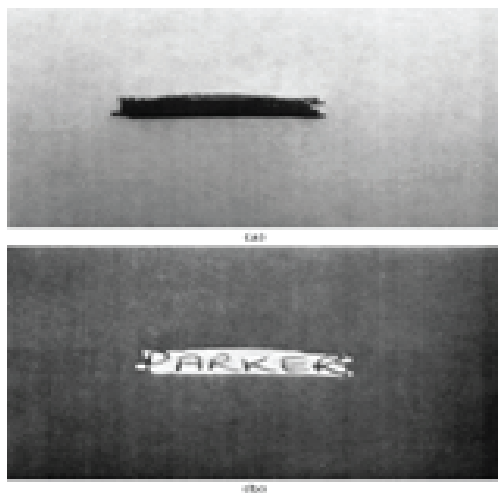
Figure 14: (a) An obliteration of one blue ink with another, photographed in normal light. (b) The same photographed in conditions suitable for the detection of infrared luminescence. Although the obliterating ink luminesces strongly, the non-luminescing ink absorbs the luminescence [5].

In addition to infrared absorption, microscopic examination is effective in heavily obliterated writings. Choice of suitable filters can reduce the invisibility if the color of obliterating ink is different. A photograph of greatest contrast can reduce the obliteration by providing high contrast for original ink with background rather than obliterating ink. An obliterated entry can be identified in cases where the original writing is left uncovered with sufficient evidence. Similarly, an enlarged photograph taken with favorable conditions can enable it to identify those obliterated lines that are faded out but left with uncovered portion of the original entry [1,5].

3.5. Digital Imaging Software

This technique was reported by William Bodziak in 2000, being used to differentiate writing ink. It was equipped with a desktop computer using digital imaging software Adobe PhotoShop 5.0 and a conventional flatbed scanner. A questioned writing ink and known black ballpoint inks were color scanned. Adjustment function was used for creating color differentiation of different black inks on the window screen of the software. From the settings of original image, positive or negative adjustments of Hue, Saturation and lightness were made. This procedure with suggested settings as Hue = 0, Saturation = +90 and lightness = -7 by Bodziak was tested and produced distinct results from the black ballpoint inks differentiation. However, this technique was not developed for ink differentiation but is effective [1].

4. Destructive/Chemical Methods

Additional information can be obtained from chemical or destructive methods but involve removal of ink or other writing materials from the paper. Therefore, before applying any chemical test to the document, a permanent record of the test entries should be made in the form of high quality photograph or with substitute of photocopy. Chemical methods such as chromatography can best discriminate the variation in ink components dried on the paper by. This technique is based on principle of separating a mixture's components and identifying or comparing them with others. It follows a stationary phase that absorbs small amount of entry material placed onto it and a mobile phase that passes through the stationary phase. The speed of material traveling through stationary phase depends on its chemical composition. Therefore, the method is ideal for mixture separation and identification based on different travel rates. The medium of stationary phase can be a solid, liquid and gas or liquid of mobile phase. Chromatography involves two methods for the examination of ink components [1,5] as following;

4.1. Thin-layer Chromatography (TLC)

Thin-layer chromatography is generally used for the comparison and identification of inks. It is distinguished from other chromatographic techniques on the bases of its stationary phase which is supported on glass, plastic or aluminum surface such as Merck TLC plates with coated silica gel but without fluorescent indicator. There are different varieties of thin layer chromatography including adsorption, continuous, stepwise, partition, two dimensional, radial, centrifugal and forced flow [7,20]. Of these, adsorption has been employed as principle method that separates

ink components by adsorption interaction of stationary and mobile phase. The non-volatile components of ink have different migration rates that cause their separation into bands [1] as shown in following figure 15;
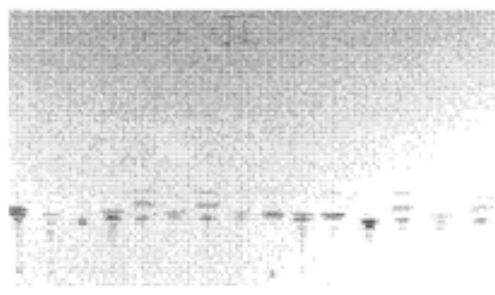
Figure 15: Blue ballpoint inks- thin layer chromatograms bands [1].

Based on the nature of the product, TLC enables immediate comparison of writing inks on the plate by separating both visible dyes and invisible organic components, whereas other organic compounds require post visualization treatments when analyzed by TLC [24,25]. Routinely four parameters visual, ultraviolet radiation, infrared luminescence and infrared reflectance or absorption are exhibited by some invisible ink components in TLC that may add further features to the identification. Such components with dim IR luminescence TLC bands can be detected by the use of video spectral analysis. UV absorbing components are revealed by short UV wavelength, while visible UV fluorescence is excited by long UV wavelength preferably using high intensity commercial long UV wavelength lamps other than standard long UV wavelength lamps. Additional description of the components can be yielded by spectrophotometric analysis of dye spots, while quantitative analysis can be obtained by carrying out densitometry [1,5].

4.2. TLC Densitometry

After identification of inks by TLC, the

relative concentrations of dyes present in these inks can be measured by scanning the TLC plate in the scanning densitometer. Blue and black inks dyes are scanned by spectrometer type densitometer at 585 nm. Whereas, all spots on TLC plates can be seen in shades of black by video densitometer that does not require wavelength settings. However, wavelength with maximum absorption by the densitometer is determined and used for scanning of other colored inks [28,30]. Relative concentrations of the dyes are compared and if found with no significant differences, then the results from preliminary and chemical tests justify a conclusion based on scientific certainty that all inks have same formulation [1].

4.3. High-Performance Liquid Chromatography (HPLC)

Similar to TLC where ink solution on a plate is evaporated as spots, HPLC uses high pressure to force the ink solution in a glass tube through a column with absorbent material that separates the components based on their different passage rates and physical properties [5,7]. The pressure is run until all the dyes have passed through the column and are detected by their merging to a device that measures either their color or absorption at specific wavelengths [5]. Quantitative analysis of each component can be obtained by proportionality of absorption to quantity of material. A graph is obtained representing the results with peaks showing presence of each component and proportions. HPLC determines more accurate proportion of the major components of the dye solution than that of TLC. However, the apparatus required for HPLC is costlier than TLC [29].

HPLC equipped with multi-wavelength detector has been used by Tabbett et al. that

distinguished 108 blue non-ballpoint pen inks out of 113. TLC as compared to HPLC, separated only 17 groups from this set of ink. However, TLC when combined with densitometry enabled the authors to discriminate all these non-ballpoint inks. On the other hand, UV has been effective in distinguishing these inks as compared to visible spectrum because ink vehicles showed UV absorbance properties. Two such non-ballpoint blue inks were distinguished by using HPLC with multi-wavelength detection as shown in following HPLC chromatograms [1];
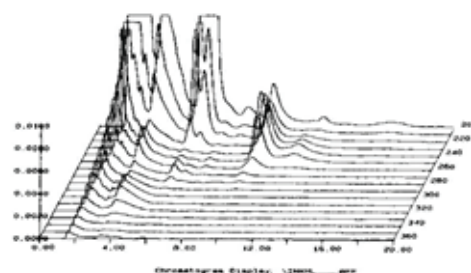

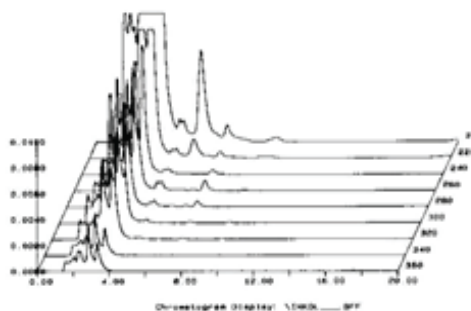
Figure 16.1: HPLC chromatogram of non-ballpoint ink 1 [1].

Figure 16.2: HPLC chromatogram of non-ballpoint ink 2 [1].

4.4. Other Chemical Tests

Other chemical methods for ink examination may be of followings:

- Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC-MS) are handy particularly to measure the volatile components of ink. However, these methods are narrowed to inks that are not older than one year because the volatile components of written ink lines are detectable only within a duration of 6 to 12 months [5,19,21&22].

- Capillary Electrophoresis (CE) or Micellar electrokinetic capillary chromatography is a recently developed method used for comparison and separation of dyes present in all kinds of writing and ink jet inks with exceptional results [17]. It has higher resolving power with prominently small sample sizes and better results than that of TLC and HPLC [1,5&7].

- In some cases, two inks can be distinguished by their solubility. The dyes of a written line with application of a solvent drop, may drain into the nearby area on the paper. In general, most of the ballpoint inks have similar formulation that react in similar way to any solvent application. However, other inks can be easily distinguished by the application of a simple water solubility test that is time saving as well as does not cause further change to the document.

- It is rare to find some invisible iron based inks that convert their colorless compounds into colored compounds by further chemical application. It can be possible in two ways: first is the exposure of document to thiocyanic acid fumes set by potassium thiocyanic and dilute sulfuric acid mixture that convert the colorless iron salt to red brown ferric thiocyanate; second is the application of potassium ferrocyanide to the paper surface containing iron ink traces that on combining turns dark blue by forming ferrocyanide [5].

5. Instrumental Analysis of Inks

Chemical methods discussed above generally provide adequate writing ink comparison but sometimes we may come across the cases where further instrumental analysis of inks with diverse discrimination is required as followings;

5.1. Spectroscopy

Spectroscopy determines electromagnetic radiation and measures its wavelength interaction with substances resulting into absorption, emission or transmittance charts. It may follow non-destructive or semi-destructive procedures with small fiber removal from ink coated paper.

5.1.1. Color Space & Visible Spectrophotometry

Visible light micro-spectrophotometry is a fast and precise source of color sampling, storing and comparing. This method when combined with computer software, transforms reflectance data into color space coordinates by producing reflectance spectrums. Ballpoint inks have been analyzed through this technique by L. Keith Kerr using chromatic data examination with increase of 43% IR video spectral discrimination and 8.0% visible range. During this, colors are placed at a chromaticity point where they coordinate with color space diagram and consider as matches if they fall within in this point. Chromaticity point was created from data generated through recording of reflectance spectra from 10 different points within the ink stroke. This technique signifies as one of the non-destructive source of ink

examination [1,16].

5.1.2. Ultraviolet Visible Near Infrared (UV-VIS-NIR) Micro-spectrophotometry & Micro-spectrofluorimetry

Ballpoint pen inks or dyes and toner particles of color copier can be compared by performing UV-VIS-NIR micro-spectrophotometry and spectrofluorimetry directly on the document as non-destructive means. However, destruction can be reduced in transmitted mode by using single inked paper fiber. According to Seipp, ink can be discriminated in both transmitted and reflected ways but encountering some problems during reflectance [1,8] as follow;

- Multiple sampling is required for differentiating microscopic surface characteristics.
- UV recording was limited to not less than 380nm while using glass objectives.
- When using fiber optics that transmit UV, support sample radioactivity event and prohibited UV shortwave usage.

Micro-spectrophotometry when compared to TLC or HPLC cannot discriminate ballpoint inks efficiently as it gives spectra based on whole ink analysis, whereas chromatographic methods are based on separation of ink components. Micro-spectrophotometry limitations in the UV region is remarkable by differentiating various ballpoint inks being indistinguishable in other spectral region such as spectra of blue ballpoint inks [1,11&16] shown in following figure;
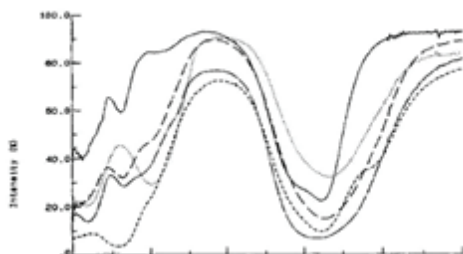
Figure 17: UV/VIS Spectrum of Blue ballpoint inks [1].

5.2. Fourier Transform Infrared Spectroscopy (FTIR)

Where color sample is measured by visible spectroscopy, its molecular features are revealed by infrared spectroscopy. Based on substance capability to absorb infrared radiation, FTIR provides absorbance fingerprint through IR beam and substance molecular bond interaction with equal vibrational frequencies. Absorption occurring at certain wavelengths, matches to specific functional groups and is measured through FTIR high resolution method that replaced older IR techniques. FTIR creates two source beams by using a beam splitter and a moving mirror to change the path difference between the beams producing intrusion pattern. Computer software then converts the time domain to frequency domain by using mathematical process of Fourier transform. FTIR as compared to dispersive instruments, gives greater throughput with higher resolution and involves numerous sampling techniques combined with different instruments for ink analysis [1,33&34] as following;

5.2.1 .Attenuated Total Reflectance (ATR)

ATR uses optically compact crystal that is pressed against the sample and absorbs IR beam by rotating it into momentary waves. Energy from these waves, is absorbed by the sample in its specific functional group regions and waves exit the crystal from the opposite end. The IR absorbance spectrum is generated from attenuated/reduced interference beam being analyzed by instrument's detector. ATR sampling method has been useful specifically in ink analysis with minute or no destruction to

the document because of shallow penetration of beam into the paper thus reducing paper interference. Penetration depth varies with respect to different types of crystal material and reduces with increase in reflections. Nicolet Continuum Microscope ZnSe ATR has been used for the analysis of indistinguishable ballpoint pen inks such as blue ballpoint inks [1,33] shown in following figures;

Figure 18.1: FTIR spectrum of blue ballpoint ink 1 [1].
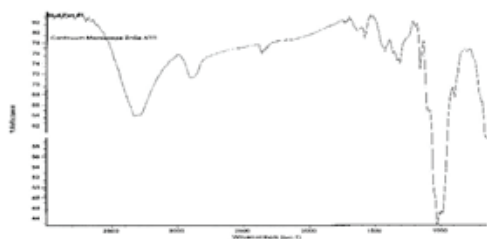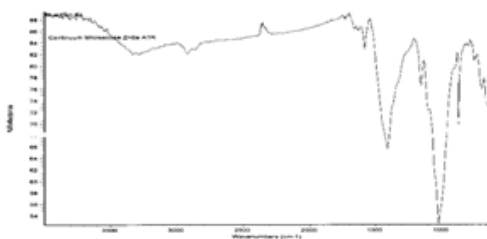

Figure 18.2: FTIR spectrum of blue ballpoint ink 2 [1].

5.2.2. Diffuse Reflectance Infrared Spectroscopy (DRIFTS)

This sampling method measures diffused IR reflected light absorption by preparing ink samples in a non-absorbing medium that increases penetration depth into the sample by reducing spectral reflectance. Thus, increasing internal reflection of components with increased transmission rate. Nicolet 20SXC FTIR spectrometer with DRIFTS has been used by Rena Merrill and Edward Bartick to differentiate visibly indistinguishable ballpoint pen inks and matched their spectra with library standards. Similarly, William & Mazzella in 1990 used DRIFTS for differentiating photocopier toners removed from the documents. They examined 'fingerprint' in 2100-700cm[1] IR range and based on IR spectra, categorized 149 toners out of 152 into 36 sets. Both ninhydrin used for latent print and toner age, did not affect the IR spectra. [1,34].

5.3. Raman Spectroscopy

Raman is the effect of wavelength change in scattered light as resulted radiation of certain substances and named for Sir Chandrasekhara Venkata Raman of India after 1930 Nobel Laureate. An intense source of radiation is required for one photon excitation to cause this change; thus laser is used as monochromatic radiation source to measure this change at angle of 90º. It results into Elastic or Rayleigh scattering, if the scattered light's wavelength does not go through radiation changes. However, if the scattered radiation wavelength changes, it results into inelastic scattering as stokes with longer wavelength or anti-stokes with shorter wavelength than that of source radiations. Raman spectroscopy commonly uses stokes changes as they are more intense with magnitude of 4000 cm^{-1}.

Both Raman and FTIR are non-destructive means of analysis but FTIR is provided with better sensitivity without any influence of specimen's fluorescence. Whereas, Raman with weak signals is concealed by sample fluorescence. However, Raman spectroscopy leads with clear peaks and gives enhanced sampling resolution of 1 micron as compared to IR absorption with 10 microns if incorporated with microscope. Raman spectroscopy usually does not follow sample preparation and gives results without paper interference. Raman spectra libraries of

desired substances including inks have been compiled by some laboratories. For example, 12 black ballpoint inks analysis was reported by Lyter in 2000 using a Foster & Freeman Foram 685 Raman spectrometer with laser power of 1.0 and compared the results with TLC for effective casework. These 12 black ballpoint ink samples based on Raman spectra were divided into six different groups including featureless group with two ink samples, and fluorescence exhibited group with two more ink samples as shown in figure 19.1-19.6. Raman spectroscopy being non-destructive, has the capability of differentiating two similar ink formulations but not the same ink formulations. Whereas, TLC being semi-destructive differentiated all 12 ink formulations [1,36].
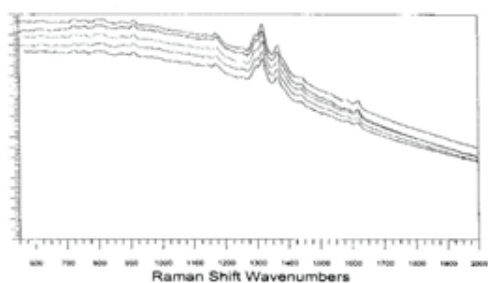

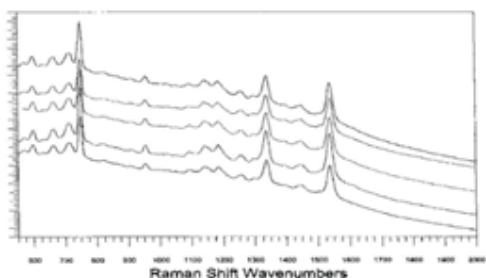Figure 19.1: Black ballpoint 1-unique spectrum [1].

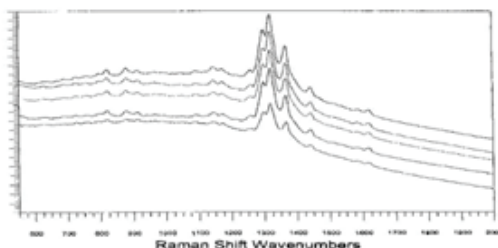Figure 19.2: Black ballpoint 2-unique spectrum [1].

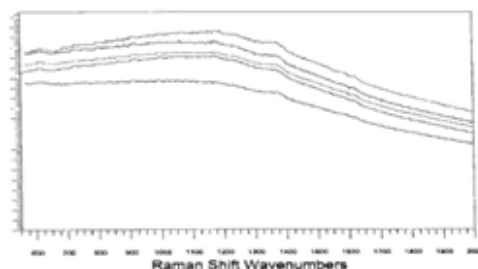Figure 19.3: Black ballpoint 3-unique spectrum [1].
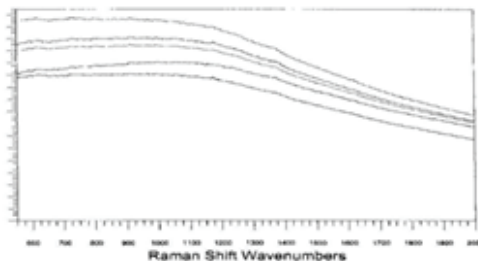

Figure 19.4: Black ballpoint 3-small features [1].

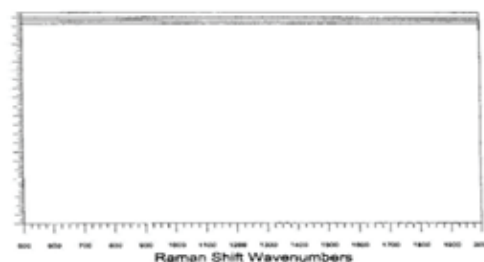Figure 19.5: Black ballpoint 4-featureless [1].

Figure 19.6: Black ballpoint 4-fluorescence [1].

6. Ink Dating

Aging of ink was determined in 1920s when chloride or sulfate ions of iron gallotannate inks along with paper fibers were verified with aging features. Early researches from past to present about dating ink have been conducted in the forensic ink examination.

6.1. The Aging Process

Inks comprise of numerous substances such as dyes or pigments as colorants, carrier solvent as ink vehicle, and fatty acids and resins work as drying and viscosity agents of the ink. All of these substances may exhibit aging properties with the passage of time causing considerable changes in the ink and can be as simple like evaporation of volatile substances and complex like oxidation of substance or resins hardening on the paper surface. Ink extraction to a weak solvent and residues of this solvent in the ink are two common aging properties. Resin hardening and solvent evaporation contributes to fresh ink aging for a period of one year. The main factor of ink aging over a year old, is the hardening of resins when examined during ink dating. Most of the research methods involve ink extraction to weak solvents [1,16].

Dating of questioned writing inks has a great demand in the criminal and civil litigations because of the growing capabilities and services of this knowledge throughout the world. Advancements have been made since the development of the first dating ink technique in 1968 and have been passed and accepted as routine in U.S. courts. Israeli, Australian, Hong Kong and Japanese courts also have accepted the testimony of such advanced methods. Therefore, it is reliable to say that these methods have been testified 1000 times by the government and private dating ink chemists [31].

6.2. Method of First Production Date

After the identification of ink, the first date of ink production with specific formulation can be verified from the manufacturer of that specific ink formulation. If the production and marketing date taken from manufacturer is not till the document preparation date, then document was not written on a claimed date. The questioned entry must have been written after first production date of ink and dated back.

6.3. Ink Tag Method

The first ink tag was added to ballpoint inks in 1970 by the Formulabs manufacturer and its use was dropped by June, 1994. Ink tags are chemicals that exhibit fluorescence properties and can be identified when reacted to ultraviolet light. Therefore, ink tag identification leads to determining actual year of ink production. TLC is used to detect and identify the ink dating tags in the same way as other questioned inks. The tags if present can be viewed using ultraviolet light and their relative concentrations can be compared with that of standard tags. However, no further information can be provided about tags as these are considered as Formulabs branded information [5,32].

6.4. Ballpoint Inks Relative Aging

Inks can be distinguished by detecting their colorants and solubility in specific solvents which is proportional to the time duration being on the paper. Solubility test is possible by assessing the quantity of extracted color in a time period during dissolving the dried ballpoint inks. Dissolution rate is determined

by taking solution samples with intervals of one or two minutes after introducing the dried ink into the solvents. If the rates of two samples of the same ink on the same document are different, say one is faster than the other, so this sample dried earlier and has been for a shorter time on the document. However, this phenomenon is not for different ink samples or a different surface so will mislead the results. Therefore, this test is only useful for writing lines of two similar inks on the same document or inks aged from few weeks to about nine months [5].

6.5. Dating of Inks

The exact time of writing ink cannot be determined by relative aging of ink nor other ink analysis but if the ink and any writing made in a certain date. This principle is applicable when the disputed dates have extended the new type of ink such as ink from ballpoint pens. Keeping in view various formulations of different inks and manufacturers, complete records and support of ink producers are required for obtaining well know information. Such collection of ink formulations is built up in the United States by the Laboratory of Alcohol, Tobacco and Firearms. The same laboratory in collaboration with ink producers in the United States, has arranged the tag method for the indication of manufacture year. These tags/chemicals even in small proportion can be detected by particularly designed analytical techniques. The presence of such chemicals also can distinguish the two inks from each other that require such comparison [1,5].

7. Guide to the Best Techniques for Ink Comparison

Any technique described above can potentially identified two inks with different chemical formulations as long as the proper procedure and technique's limitations are followed. Some methods can have greater percentage of ink differentiation than others but all non-destructive methods available should be tried first by flowing thumb rule. However, at current the high performance thin-layer chromatography (HPTLC) is believed one of the best semi-destructive techniques with combination of simplicity, economy and performance. The two techniques, HPLC and capillary electrophoresis are considered more selective than HPTLC but both have higher initial equipment investment and do not perform side by side sample analysis.

Different techniques are combined to provide evidentiary results for identical ink formulations by measuring different chemical factors. It is of evidentiary significance if rarer pen matches in formulations. However, only matching two ink formulations chemically does not prove that the two written entries were made with the same pen. But ink formulation can be associated with the pen if it is unique such as the DNA Pen. This is the product from DNA Technologies, Inc. which is not typically encountered in casework. The written lines produced by this pen can be matched with it by forensic DNA testing as the ink used in the pen is combined with owner's DNA [1].

8. Ink Libraries

Ink standards required for identifying ink formulation can be obtained from ink manufacturers by accessing inclusive collection with information such as ink manufacturer, ink formulation number and first manufacture date of particular ink formulation. A complete ink library should have numerous thousand ink standards by being updated annually. Up to date standards should be obtained from different manufacturers from

different regions of the country preferably different countries and ask for a difference if encountered with similar ink standards. Manufacturer companies are supplemented to obtain the standards of pens being purchased in retail stores. It is important to inquire the pen companies about the ink information that they use in their pens as most of the pen companies do not manufacture their own ink product rather they purchase from other ink suppliers e.g. Dokumental or National Ink.

The ink standards in an ink library are deposited on plain white photocopy paper as a whole written page if the ink standard is in the pen and as a smear onto the paper by using cotton swab if the standard is in the form of bottle or tube liquid ink. The deposited written ink standards are completely dried prior to storing in a file of ink library and are provided with limited exposure to light so that to reduce ink's fading. Ink standards storage is based on ink types and colors that will simplify the recovery of an accurate ink standard during comparison of questioned ink. In ink library, every ink standard should be evaluated by TLC with different concentrations from weak to high on the same TLC plate that is stored suitable size of envelops for future examination [1].

9. Conclusion

Each suggested techniques may provide valuable information if applied appropriately and incorporated with other reliable methods. Preliminary visual examination combined chemical methods is commonly recommended by many forensic experts for ink analysis. The ink chemists should be aware of certain factors that may influence the written entries such as aging processes and technique's limitations. Thus, the volatile components that evaporate as aging entries should not be the only piece of information when performing comparison or identification process. Similarly, caution is required when performing dye based examination as there may be possibility of dye degradation in both qualitative and quantitative explanation of the resulted data. Furthermore, ignoring aging mechanisms may lead to unexpected false negative outcomes during comparison of writing materials with varying chemical profiles. Therefore, research should be focused on validating current techniques and introducing standard procedures assisting reliable interpretation of results rather than developing new analytical methods.

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A Non-Parametric Analogy between Oracle & MySQL

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Abstract:

Database Servers store, manipulate and retrieve critical information. In current computing era these database servers are often exercise unauthorized access, security breaches and violation. A sub field of digital forensic called Database Forensic deals with the study of database and about their data. Oracle server and SQL Server are two database server actively used by digital industry for their data store. This research paper is a detailed non parametric comparison between oracle server and SQL Server that helps forensic investigators in DB tool selection for the sake of forensic analysis and investigation of databases. According to findings oracle is more secure than SQL, oracle data types are more flexible than SQL. Both tools are good at query optimization but oracle is more expensive than SQL. This comparison is made with the expectation of escalating research in database forensic analysis and investigation areas.

Keyword: Data Model (DM), Data Definition Language (DDL), Entity Relationship Diagram (ERD), Database Administration (DBA), Query Execution Plan (QEP), Automatic Workload Repository (AWR), configuration management pack (CMP), Oracle Manager Console (OMC), Oracle Real Application Cluster (Oracle RAC)

1. Introduction

In the modern computing world, databases expanded quickly and have been used in computer applications and information technology development. Database development is the process of a problem specification and requirement analysis; provides a mechanism for data's logical structure. Data constraints, needs, requirements, and purpose are covers in the problem-solving definition in some organizational operations. Firstly, logical structure is built by some simple language or plain text, like simple finite series of statements, and later these statements trans-

formed into a complex model known as "Data Model" (DM). DM will provide the directions towards the conceptual view or level and then mapped it as metadata (data schema), which is known as "Data Definition Language" (DDL).

SQL statements created in the form of tables, indexes, and views within systems of a relational database such as DDL. DM expressed as "Entity Relationship Diagram" (ERD) and these diagrams are transformed into metadata through a database tool. Some tools are also available in the market to perform reverse operation (reverse transformation) means from metadata to ERD.

When we talk about the database, our main concern is how logical data designs are generalized into "physical database", which means our concern is about physical design. Database scientists said that logical data design is an art more than a science concept. In the database, we treat an independent presence of real-world thing as an entity. Entity and entity type are terms used interchangeably in many situations. Simply, consider entity type as a class notion (as we used in "object-oriented" design). Entities collection is known as entity type (entity instances) and object collection is known as class instances.

In physical database, tables are treated as entity types and tables records (rows) are known as entity instances. For example, company, person, department, location, students are entity types. Attributes are the descriptive property of an entity (Elmasri at al., 2004). They are used as entities with relevant characteristics and they have their own types. For example, a person is an entity then person age is an attribute of that entity. Each entity type has a key which is actually a subset of entity attributes and used to uniquely identify the entity instances (many keys are used in

databases like primary key and foreign key). The next thing that comes is the relationships of logical data. Relationships R is types of relations among data entities. For example, STUDENT is an entity and REGISTRATION is the entity instance, then relationship type is considered as COMPLETE. For any problem-solving technique, entities and their relationships are the main ingredients in the analysis.

2. Oracle Database:

Database Oracle gives new directions in several major areas of innovations like storage management, performance management, data warehousing, change management, data guard administration, and many others. The latest version of Oracle is more secure and robust, user friendly in terms of easiness gives better performance. All the function of DB is fully supported by the ODB such as storage management, memory management, get back up and solve recovery; performed by its administration known as "Database Administration" (DBA). The difficult task of DBMS in real-time systems are testing, tuning, and managing.

When we talk about environmental efficiency related to the task, self-optimization is the way to improve efficiency (Deari et, al. 2018). Query optimization, automatic Database diagnostic monitoring, automatic statistic collection, and automatic workload repository are the four components through which Oracle performs self-optimization.

2.1. Query Optimization:

Query optimization is done in four steps. Firstly, the Oracle database identifies load queries that have higher priorities and have a higher rank, secondly, it made a plan which is

optimal to load queries. At the third step, it generates an improved version of "Query Execution Plan" (QEP) and in the fourth step it generates the best execution plan for the query (Dageville et al., 2004). Query optimizer utilized the user-selected setting/recommendations (which are stored in the SQL profile) and then generate the best execution plan (Padhyet al., 2011). The heuristic-based approach is used by the query optimizer to perform optimization, and even the user can set response time or throughput as optimization goals (Barlowet al.,2003, Elnaffaret al.,2003,Clarenceet al.,2012).

2.2. Automatic Database Diagnostic Monitor:

The database provides a central intelligence (Diaset al.,2005,Wei-Pinget al.,2011) such as high load execution request, concurrency and configuration issues, memory structure, the bottleneck of CPU, fragmentation analysis of space, and SQL tuning. In Oracle last version (Oracle 10g) management of monitoring was done through observe, diagnose, and resolve phases. All these phases have performed these functionalities in iterative nature.

2.3. Automatic Statistics Collection:

Oracle has the ability to generate several statistical types such as operating system (OS) and Database interpreting statistics. If we further expand OS statistics it handles virtual memory, CPU, network and disk statistics, and in-database statistics active session and events wait are being handled.

2.4. Automatic Workload Repository:

Oracle has the ability to stores the snapshot (on

the hourly basis) and performance data. In a repository known as "automatic workload repository" (AWR). It used to collect the data from statistics and send this information to other components (like SQL Tuning Advisor) to enhance the overall performance.

2.5. Self-Configuration:

The property of configuration itself but according to the objectives and goals are known as self-configuration. Firstly, Oracle has a "Configuration Management Pack" (CMP) which contain all the configuration related issues. The main aim of this CMP is to minimize the tedious tasks and heavy labor of DBA to provide an efficient environment. Through this pack, Oracle achieves standardization and scalability. Secondly, it used SQL Access Advisor (SQL AA) to support various workload types. Through evaluation mode and problem-solving mode, it enhances the partitions and index structure and provides efficient access recommendations. Thirdly, Oracle has a shared memory management concept (Kumaret al.,2006,Gornshteinet al., 2004) in which it handles the memory distribution according to object and workload requirements (Sanobaret al.,2013). It provides the best possibility of available resource utilization through which we can get much reduction in expenditure.

2.6. Self-inspection:

Self-inspection is the Oracle property in which it can make intelligent decisions based on self-awareness. For that purpose, Oracle uses a "manager console" (OMC) to automatically examine all the time system health. If any sign of un-health occurs it generates alerts and stores systems performance. OMC observes application concurrency, memory consumption, logging, and storage issues.

3. MySQL:

MYSQL has been widely used due to its open-source database nature. MySQL is a "Relational Database Management System" RDMS provides the functionality of an access database to the multi-users and runs as a server. "My" at the beginning of MySQL took from the Finnish developer (Oracle 12c Database 2016) daughters name. SQL is designed to serve data as a relational model in databases. It stores data in "tabular" representation and for data access it uses structured query language (SQL).

MySQL has several types of storage engines through which it provides different indexing mechanisms, storage technique capabilities, and several features. the essential function of a database is to provide managing and storing data to its end users with better performance (Laurence Goasduff, 2020).

3.1. MySQL Storage Engines:

MySQL has different techniques to store data files. These techniques provide better functions and high speed for data execution through which overall application functionality will increase. These mechanisms and their functions are treated as "storage engine".

3.2. Database Security:

MySQL provides security features to authenticate its users with user name and password and also used an additional security parameter known as "Location". Location parameter contains user/host IP address and name. another feature in terms of security used in MySQL known as "Privileges". MySQL privileges system is a hierarchical structure system that operates as an inheritance. Through privileges MySQL performs five different levels of security known as 1) global, 2) pre-host basis, 3) database level, 4) table-specific, and 5) column-specific. Each of the above mention levels has a grant table in a particular database. At each step it performs privilege check by checking the privileged scope.

4. Comparison:

The above sections provide detail about the Oracle and the MySQL components and their functionalities. This section provides a summary of both the Oracle and MySQL comparison and through comparison, we try to evaluate both the database approaches. In our applications, databases are the core element for the management system. Some vendors such as MySQL AB (MySQL Database 2016), Oracle (Oracle Database 2016), and Microsoft (MS SQL Server 2016) develop RDMS and made some databases licensed based and some are open-source (Oracle 12c Database Features 2016). To check the performance of the database, each execution time is measured (in milliseconds) and build a graph (to perform comparison graph with other approaches) to check whether the database execute faster or not and which execution time is taken for the queries. The detailed comparison is shown in table 1 to 11.

Oracle	MySQL
RDMS	RDMS
Oracle corporation	Affiliated with Oracle corporation
22 July 2013 (Kumar.,2006)	MySQL server 5.7 October 2015
	(Gornshteinet al.,2004)

Features (Mateenet al.,2009)	
Provide tools for UML	Optimizer
Popular for security purposes	Provide security
Perform optimization	Open GIS classes
Improved column defaults	Partitioning
Increase size limit	Client program
Improved top-N-Queries	Building changes
Database archiving	
Online migration	
Transaction Guard	

4.1. Schema Migration:

This schema contains the data related to table definitions, users, indexes, views, stored procedures, constrains and other specific objects related to database.
Schema object similarities in Oracle and MySQL

Functions	Oracle	MySQL
Trigger	Yes	Yes
Check constraint	Yes	Yes
Column default	Yes	Yes
Database	Yes	Yes
Foreign key	Yes	Yes
Index	Yes	Yes
Package	Yes	Not available
PL/SQL function	Yes	Routine
PL/SQL procedure	Yes	Routine
Primary Key	Yes	Yes
Role	Yes	Not available
Schema	Yes	Yes
Snapshot	Yes	Not available
Table	Yes	Yes
Unique key	Yes	Yes
User	Yes	Yes

MySQL use some reserved words like TIME-STAMP and DATE but Oracle don't allow them.

4.2. Character datatype:

Both databases have different character type values.

	Oracle	MySQL
Character datatype	CHAR, NCHAR, NVARCHAR2, VARCHAR2	CHAR, VARCHAR

4.3. Column Default Value

Oracle differs from MySQL in the way it doesn't handle default value for a column that does not allow NULL value. Means MySQL doesn't allow null values in the column, and no data is provided to the table for the null contain column. In Oracle, data must be given for all the columns that don't allow the A NULL value (when inserting the data value in the table)

4.4. Times and date types

The date and time types of MySQL to Oracle

Size in bytes	MySQL	Oracle
03	DATE	DATE
04	TIMESTAMP	DATE
08	DATETIME	DATE
03	TIME	DATE
01	YEAR	NUMBER

4.5. Database Deploy:

MySQL	Oracle
Written in C, C++	Written in C, C++, Assembly Language
Support following Languages	
• C • C++ • JAVA • NET • Python • PHP • Go • R • Lua • Perl • Erlang • Node.js • LISP • D • Delphi	• C • CC++ • CJAVA • CNET • CPython • CPHP • CGo • CCR • CRuby • CPerl • CErlang • CNode.js • CRust • CCOBOL • CFORTRAN

4.6. Type of replications and Clusters:

Replication is known as the process of allowing multiple data copies which are automatically copied from MASTER database to SLAVE database. Whereas clustering is referred as a shared storage and allow front-ends of multiple databases.

MySQL	Oracle
Replication	
One way asynchronous	Enables data integration and replication
One server performs its duties as MASTER and another act as a SLAVE	Allow propagation of data, data streaming (within a database or one database to another database)
Cluster	
Allow share nothing clustering (no single point of failure)	Use a "Oracle Real Application Cluster" (Oracle RAC) to allow interconnection of servers and computers. For this it uses Oracle Cluster ware (an infrastructure to tie up multiple computers)

4.7. Community Support:

MySQL	Oracle
Support community options	Support community options
Support commercial ones	Also allow paid support options (web - based support)

4.8. Documentation Maintainers:

MySQL	Oracle
Community-based and official documentation available	Help center available with feature guides

4.9. Queries

Usually, MySQL and Oracle quires are exactly the same in context.

Creating a student database	
MySQL	**Oracle**
CREATE DATABASE students	CREATE DATABASE students;
Creating a student table	
MySQL	**Oracle**
CREATE TABLE student (	CREATE TABLE student (
Stu_id int PRIMARY KEY,	Stu_id int PRIMARY KEY,
Branch varchar (255),	branch varchar (255),
Status varchar (255));	status varchar (255),
	CONSTRAINT student_pk PRIMARY KEY (Stu_id));

4.10. Database Organizations:

MySQL	Oracle
• Facebook • YouTube • NASA • BBC News • Apple Inc. • US Navy	• Airtel • Apple • Amazon • LinkedIn • Sony Corporation

Parameters	Oracle	MySQL
Hardware requirements	1GHz processor, 1 GB RAM, 2GB Disk space	200 MHz processor,64 MB RAM, 100 MB Disk space
Operating System	Windows, Linux, MAC OS	Any windows, Linux, Unix, MAC OS
Max Database size	OS limited	OS limited
Query optimization	Yes	Yes
Auto tuning	Yes	Yes
Password Management	Yes	Yes
Price	$180	Free
Works with	works with both dynamic and static systems	only works with static
Provides	only provides Forums support	provides on-site and phone support

Conclusion:

The ever-growing need of preserving and manipulating data stored in databases highlights the need for in-depth understanding and forensic investigation of databases. At the end user schema/level most Database Management System (DBMS) are similar to each other. According to former said level most DBMS contain relation, relationships, degree of relationship, cardinality of relationship, a structured query language, primary key, entity integrity, foreign key, referential integrity, and data about data. With respect to external/physical schema file structures, concurrency methods, security methods, query optimization and data warehouse techniques, database tools may be drastically different from each other. To serve the purpose of database forensic analysis and investigation, we carry out the detailed comparison between conventional database tools e.g., SQL Server and Oracle server. According to findings oracle is more secure than SQL, oracle data types are more flexible than SQL. Both tools are good at query optimization but oracle is more expensive than SQL. We find both tools to be helpful to perform database forensic analysis and investigation but there is a tradeoff as the oracle tool is much more expensive than SQL.

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The Unseen Web, an Enormous Mass of Internet

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Abstract:

Deep web is the part of the internet; it holds 99% of the internet rest of the internet is known as surface web and it is access able by standard search engines, Deep web is famous by different names and can be called as invisible and hidden web but it can't be accessed by the standard exploratory engines this is due to the un indexed contents by common exploratory engines. Deep web content is invisible under HTML form. Deep web provides anonymous internet platform for hackers, government agencies and others. Due to this no one can trace the location of the user and don't have any kind of information about the web surfing of the user. Dark web is the part of Deep web, the reason behind it commonly used for the black market i.e. Drug sale, ammunition sale, and many other illegal activities. It is the consist of millions of websites some of which are very informative. While on the other hand some of the portion is legal to visit and rest is illegal. These websites can be accessed by using the popular tools, i.e. TOR, I2P which provide anonymity. About 2 million people use the TOR browser to browse deep and dark web.

Keyword: Surface web, Invisible, Deep Web, Anonymity

1. Introduction

Most people consider that they have complete access to the Internet. But they even don't know that the internet which they have access is just 1% and is known as "Surface Web". The leftover internet is 99% and is known as "Deep Web". The resources in Deep and Dark web are not indexed in common search engines like yahoo and google. The Dark Web is a fragment of Deep Web and is not index able so it can't be accessed by simple search engines but can be searched by [1]. Harvest engines. Deep web contains many contents like online forums, baking services, chat room services and many more and these services can be used by paying payment. But the dark web is not index able due to its materials and some other reasons [2]. Dark web is famous for the black market of drug selling, Ammunitions, Pornography, selling of credential information's and exchange of virtual currency and for many other things [3]. Some

people use it in a bad way and others have a positive point of view. Its use is dependent on the mentality of users like criminal use it for criminal activities like cyber terrorism and journalists use it to gather some hidden information about some politics or any other issue which they want to expose in front of people [4]. The leading reason for the usage of Deep web is secrecy, deep web provides anonymous internet so hackers, government agencies and no one can trace the location of the user [5][6]. Only 32% content has been legal and 68% are illegal on deep web [7]. Users can access the Dark web by using the special browsers like TOR, FREENET and I2P they provide anonymous access to the resources of deep and dark web.

Deep web and dark web have enormous mass of internet and according to rough estimate it contains 7500 terabyte data [8]. About 2million peoples use the TOR browser or other networks to browse deep and dark web [9]. It consists of different levels nobody can access it completely [10]. It is divided into different levels on the basis of its content's danger level. Following are the different levels of the web.

• Common Web or internet

We usually use it daily and we are well known to it. Mostly it contains the contents which are "Open to the Public".

• Surface Web

It is also known as invisible web it is only 0.03% of internet It provides services such as Reddit, Digg, E-mail, chat board MySQL databases and social enabling contents are found here. The Surface web contains about 4.5 billion websites which are indexed by different search engines. The Surface web contains 19 Terabyte of information.

• Bergie Web

It has FTP Servers (4chan), honeypots, loaded webservers and google locked results. The Proxy is required for further access.

• Deep Web

It consists of the following things, heavy jailbait, Gore, On the Vanilla Sources, celebrity scandals, VIP Gossip, Hackers, Script kiddies, Raid information, Blue Prints, Virus Information, XSS Worm scripting, Mathematics research and many other information.

• Charter web

It is categorized into two parts. The first part can be accessed by using TOR. It contains information like hidden wiki, banned video, books, movies, Trade of Rare animals, Human trafficking, Personal records, billion dollar deals and black market. The second part can be accessed by modifying a hardware information which is a "Closed Shell System", it contains hardcore CP, World war 2 experiments and Atlantis Location [11].

• Marina's Web

This layer is having a lot of information about the secret documentation of government and many organizations. You will be the lucky person if you got access to it.

• (?)

This layer lies in between 5th and 7th layers. At this point people are not aware that they are in the attention of someone and it can be very dangerous. For example, individuals can reach at your destination to kill you.

• The Fog/virus soup

The best way to describe the level 7 is relating

it with a war zone. Where the creator of it is trying to approach the 8th level, but preventing other people to access it.

• The Primarch system

This is the last level of the web. It's impossible to have direct access to that level. The Primarch system is some unknown thing which is controlling the internet all over the time. Even government and organizations have no control over it. It was unintentionally discovered in 2000's during deep web scan [12]. It is the "Final Boss of the Internet"

Effect on Privacy and Business

The Deep and dark web provide iceberg of the internet each and every thing here can be sold out like from your personal information to the big critical documentations. It is the black market for the drugs, selling of personal information, deals of ammunition. Deep web or dark web itself is not safe anonymity of search and identity is provided by TOR, I2P, FREENET etc [13]. Your information and identity can be compromised because deep web is full of hackers. Hackers always try to access user's information who uses this web frequently. Therefore, you are not secure while browsing deep or dark web.

It can provide anonymity but does not assure privacy it can have large impact on confidentiality [14][15]. To protect privacy one must not surf, deep and dark web and also use precau-

tionary measure to save data from being going out into deep web.

Following measure can be done to save data from being stolen.

- Assures that the web you are visiting or your own website is encrypted with an SSL certificate [16].

- Create backup of all data and information, so that in case of any attack it can be recovered.

- Educate people and employs about the cyber security [17].

- Use dual authentication factor, and choose strong password [18].

- Don't put personal information on the web.

Anonymous systems for accessing Deep Web

TOR Browser:

Tor browser basically works on the basis of the onion method in which data that is to be sent by user, first encrypted and then send through different sources in the Tor network. Data is encrypted in multi layers of browser. The Tor is a type of browser that removes the identifying information so that original source cannot be traced, makes it easy to protect the user identity.
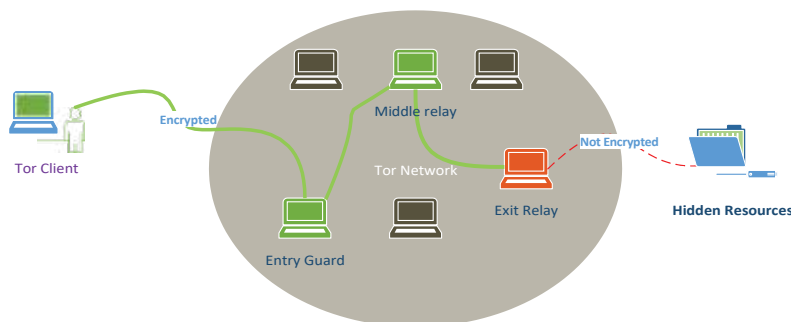
Operational Working

Tor browser uses three different layers [19].

In first step data is entered by using an entry node from the user side, then it enters in a Tor node and finally spits outs user data through the final exit node.

In 2nd step Tor browser services gets users IP address and guess the country and language automatically, but when using Tor, you will often appear to be in a physical position halfway just about the world.

If the user exists in a system that blocks Tor or need to access a web service that blocks Tor, you can also construct Tor Browser to use bridges. Like Tor entry or exit nodes, bridge

IP address is not shown publicly so it's difficult for web services and government to get these IP addresses and block them.

Features:

- Tor browser is simple to use as other browsers.

- It is high speed network of Onion Router [20].

- It can be downloaded and used on different types of operating systems.

- Tor browser only access the Onion web sites that are only available in the Tor network.

- Government agencies have the information about which sites users have visited, how many times, how long and from where all these services are provided by Tor to their users

- It sends data through different virtual routers; current router only has information of one backward and one forward router so it's become difficult to track the location and identity of the users.

I2P:

12p is a mostly used internet tool that makes the usage of internet services pretty easy. It's basically created to access the un accessible portion of the internet. I2P provides the short developer guide to make a website over the network. It works as a layer over the internet which create possibilities for the users to exchange the data [21].I2P can be used to create a web service or to use the web services. The network has no central point to store the information. Its development starts in 2003 and updated time to time.
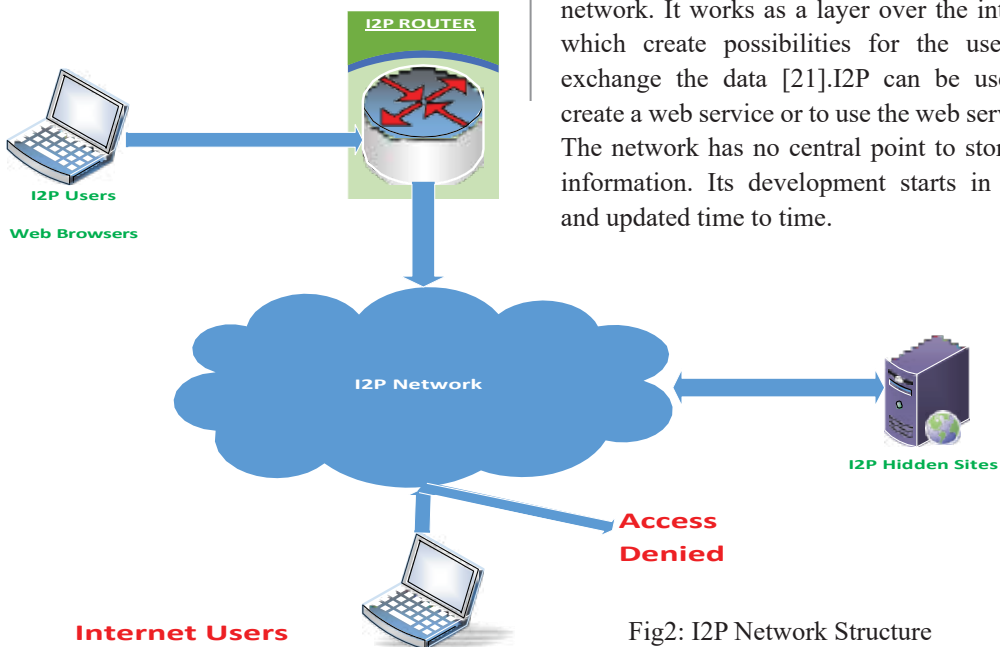

Fig2: I2P Network Structure

Operational working:

12P network consist on different virtual routers. A router can be defined as a piece of instruction that enables the services to communicate with one another. In this network sender and receiver don't interact directly with one another instead of direct communication their data passed through different routers. Each sender and receiver over the internet work as a router as well. Hence this type of communication cannot identify the users.

Features:

- Data cannot be extracted from the network and cannot access outside the network.

- It can perform the same activities like internet but without disclosing the private information of users.

- Different types of tools are available to access the services of browsers but 12P creates its own tools to avail the services of network. Therefore, this feature makes it

much faster than other browsers.

- Sending message peer to peer used less spaces so it's difficult for the attacker to attack on it.

- Updating is done with time to time that increases its usage abilities.

- A major setback of this network is that it is still considered as an unexperienced network.

Freenet

Freenet browser is a secret key based file sharing system with the aim of sharing information without knowing the actual source [22]. Creator of this browser starts project with the goal of sharing information secretly and for freedom of speech. When a user sends the information over Freenet network, it's difficult to find out the destination where information is being stored. Information also moves over the Freenet network according the demand of users.
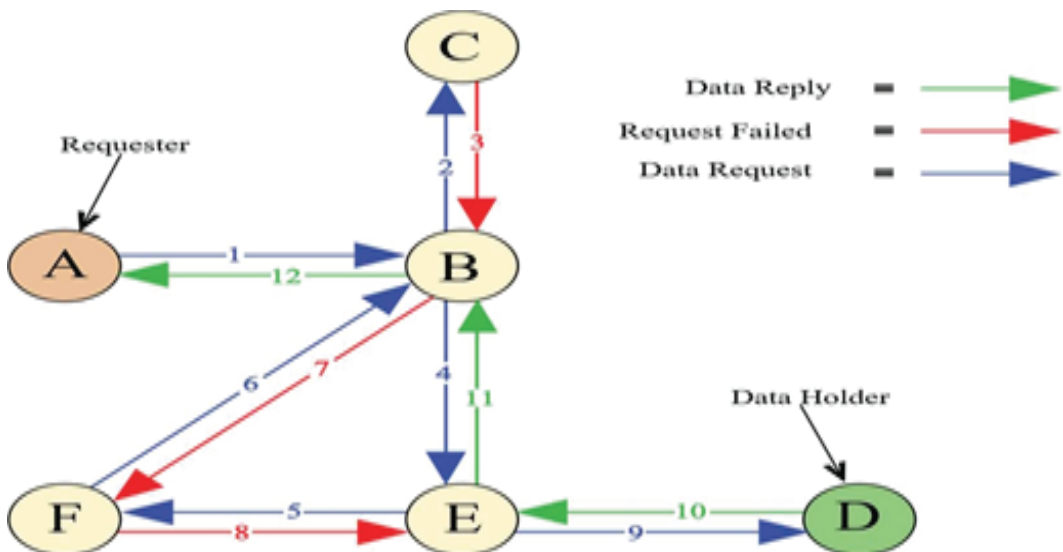

Fig3: Freenet Network Structure

Features:

- Freenet keeps files in well-organized way against some secret key. Each file stored over the network have a unique key. Whenever user need to get the file he will provide that key to the network and get the that particular file in return. Once a file is submitted to it, it's contents as well as content type cannot be changed furthermore and it has TCP/IP protocol [23].

- Running network is implemented with the help of java language which executes on windows, Linux etc. Freenet network system provides unsigned files and message sharing facilities.

- This network can only access that data which has already stored in it. Hence it is simpler in use as compared to other networks.

- Freenet provides peer to peer connections by protecting the privacy of both users, one who is sending the files and 2nd who is retrieving that files. Data stored by the user saved in the form of pieces over the network, while getting that stored those pieces are found and combined.

Architecture:

Freenet network works in the form of modules. These modules use "Freenet client protocol" for programs to use. Different applications used multiple services for sending files and sharing messages. As it contains a secret key for a file hence the stored file is encrypted, no one can access it using nodes of Freenet network without knowing that decrypted key. Getting the data from network is time consuming procedure it compares the key node to node. When it finds the related file or data, it stops checking the nodes of network. Freenet follow the stack concept for data storage.

Comparison:

Following is the comparison of three different anonymous networks of deep and dark web through which unseen web can be accessed [24]

Sr #	TOR	I2P	Freenet
Table1: Comparison of TOR, I2 P, Freenet			
1	Tor browser basically works on the basis of the onion method in which data that is to be sent by user, first encrypted and then send through different sources in the Tor network.	12P is a network consist on different virtual routers. A router can be defined as a piece of instructions that enables the services to communicate with one another.	Freenet browser is a secret key-based file sharing system with the aim of sharing information without knowing the actual source you can also create sites.
2	Tor ultimately route the traffic to the different random routers present in network to provide anonymity to all kind of users.	In this network sender and receiver don't interact directly with one another instead of direct communication their data passed through different routers.	Freenet protect the privacy of both users, one who is saving the files and 2nd who is retrieving that files.
3	Single router has just the information of forward and its backward router so due to this reason user identity or location cannot be traced	It has tunnel services it provides two tunnels to its users one is inbound (Receive message) other is outbound (Send Message)	It is decentralized and store pieces of data on user hard drives and data pass through different nodes and this make difficult to track the location of the users.
4	It provides client server, multi layered and end to end data encryption.	I2p also has the peer to peer, multi layered and end to end data encryption of user communication.	It has the same feature as tor and i2p has like peer to peer, multi layered and encryption.

Legal or illegal?

Tor, I2p and Freenet browsers are legal to use. Different countries have different rules related to the usage of these browsers [25]. China has banned the secrecy services of these browsers. Most countries working hard to stop citizens from using these networks.

Many authorities' hates these networks because by using services of deep web make it is easy for the reporters to report corruption or other illegal activities done by the politicians. Sophisticated users supporting Tor for freedom of expression, communication and publish around the world. These types of users provide bandwidth to the network.

If you are investigating a person related to you or paying role to resolve a legal dispute and that it's not good for your privacy, then the usage of this browser might be the right solution.

Pros and Cons of Deep and Dark Web

• Private information can be shared without government courier finding out.

• That information can be accessed which is blocked in a particular region.

• Deep and Dark web also provides a display space for against the law actions.

• Provides a platform for trading of harmful products like Drugs, weapons, fake passports, eBooks and hacking tools.

• Traders don't know that they will get the same material what they order.

• The User has to follow the correct steps in order to access the deep and dark web otherwise it can be privately dangerous for the user.

• Another major advantage of dark web is it contains a strange community, where people can share their experiences and give advices.

• Deep and Dark web provides "no physical contact" service

Conclusion

This paper embraces an outline of deep, dark web and comparison of three networks Tor, I2P, Freenet, to create consciousness about the unseen web and the operation of three different networks which provide anonymity to its users. Benefits and hindrances of unseen web to us and how much adverse effect it has on our privacy. Unseen web is the place where you can sell and buy each and every thing without being tracked by government and intelligence organizations. Deep web is the part of the internet; it holds 99% of the internet rest of the internet is known as surface web and it is accessible by standard search engines, Deep web is famous by different names and can be called as invisible and hidden web. Many authority's hatred these anonymous networks because their services make it easy for the reporters to report corruption or other illegal activities done by the politicians. Sophisticated users use Tor for freedom of expression, communication and publish their point of view around the world. These types of manipulators provide bandwidth to the network. This paper also informs us that which network is safer and more anonymous. I2P and Tor both are analogous to each other and provide anonymity where Freenet also provide anonymity but it has decentralized database with its application and is even more useful as an anonymous network.

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Challenges and Opportunities of Big data in Health Care

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Abstract:

The term big data is referring to huge amount of structured and unstructured data. The concept of big data is based on three V's that are volume velocity and verity. Health care industry is produced huge amount of data every day. As all the things and industries become globalized, the health care industry also becomes digitalized. For the purpose to solve the human being health issue the research applies big data technique to analysis the huge amount of data. In this article complete review about using of big data health care industry is presented. The main purpose of this article is to discuss about all the challenges which create hurdle to create opportunities in implementation of big data.

Keyword: Big data, Health Practitioners, Health Care, Electronic Health Record.

1. Introduction

The massive amount of data in biomedical is create a big challenge for the scientist. The size of biomedical datasets are in zettabyte which create hurdle in the storage and analysis process of these datasets[1]. As the world becomes digitalized and the trends of smart city become more popular, the scientists more focus toward the big data techniques. Because these techniques help them to store and analyze the data in more efficient manners[2]. The medical big data sets contain text documents and images. The analysis of medical dataset help scientist in enhancement of living standards of human beings[3]. In this paper, review of medical big data is presented. The application challenges and benefits of big data is discussed in detail. During the implementation of big data techniques storage, data collection classification and security is the main challenges for the scientist. Big data applications in health care system are helpful to enhance the health standards.

2. Big Data

Big data is a term which is used by researcher and developers for the terabyte and zettabyte datasets on which traditional approaches of data mining are not applicable. Bigdata is

applicable on structured and unstructured data[3]. A one proper definition of big data is not available[4]. Different researcher defines it differently, some of them define big data with three V's volume, velocity and verity. But some researcher define it with five things that are volume, velocity, verity, complexity and variability[5]. The details characteristics of bigdata are shown in figure 1. Big data drive forms any type of data like videos, images and text data. There are various types of big data, where long-established database systems are based on the structured data.
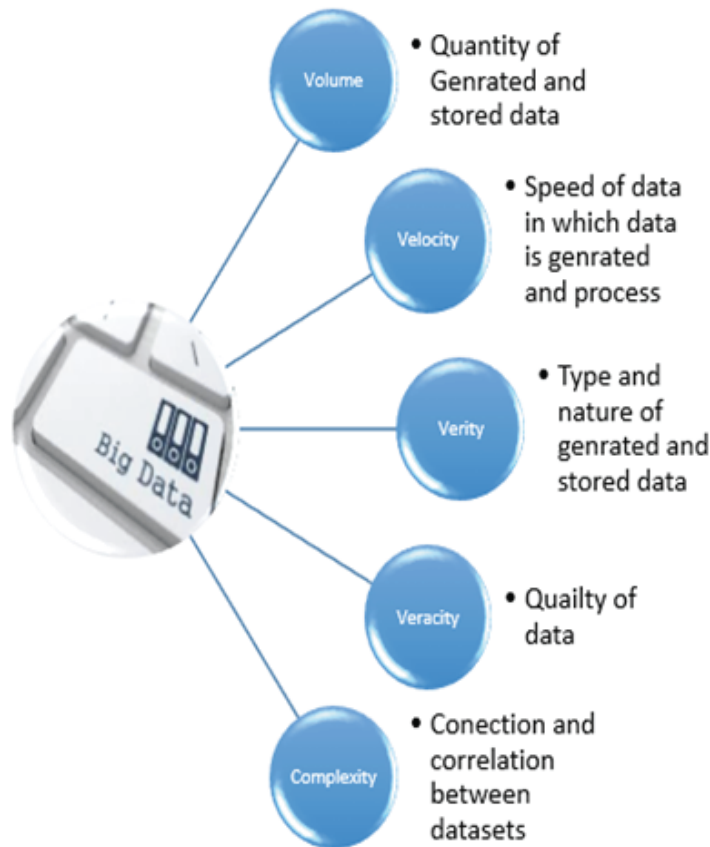

Figure 1: Characteristics of Big Data

Big data is categorized in the 5 V's: A one proper definition of big data is not available[4]. Different researcher defines it differently, some of them define big data with three V's volume, velocity and verity. But some researcher define it with five things that are volume, velocity, verity, complexity and variability[5].

The data for this review article is collected form springer, IEEE, Google scholar and PUBMed by using "Bigdata in health care" and "Bigdata health care applications" queries. The literature review process with inclusion and exclusion process is shown in figure 2. The year of selected review article is between 2014 to 2018.only 25 articles are selected form Million of articles as shown in figure 2.
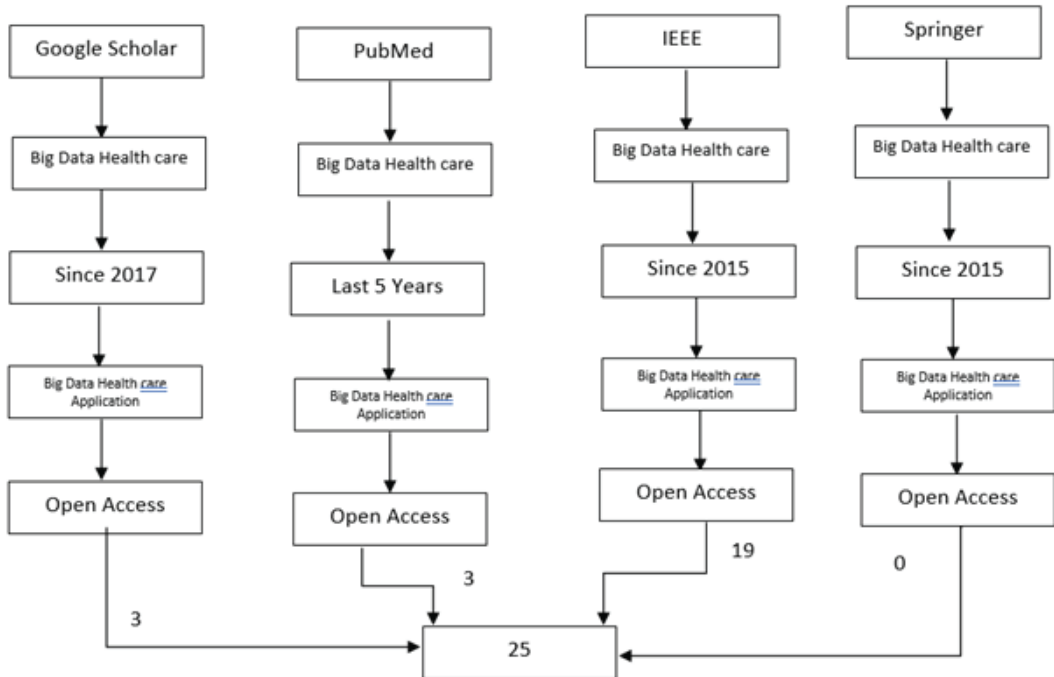
Figure 2: literature review process with inclusion and exclusion process

3. Related work

Big data and smart device revolutionized the health care system as shown in figure 3. As the world become global village the concept of Silicon Valley is more popular. In Silicon Valley all the work is done on digital devices. Health is an important issue which address by the scientist. The digitalization of health sector is helpful to secure many lives. For this context many are already done.

The researcher give the concept of a smart city for health care system by using cloud computing and deep learning techniques[6]. CC offer ability and function like compute, store, and applications via inter-net. In the broad-spectrum, to render smart phones energy efficient and computationally capable, major changes to the hardware and software levels are required. This causes the cooperation of developers and

manufacturers [16].In other article the researcher introduce the block chain with the combination of IOT techniques for automated health care system[7], [8]. Big data and machine learning algorithm make resolution in health care sector. Machine-Learning, then again, approaches issues as a specialist advancing through residency may: by taking in principles from information. Beginning with patient-level perceptions, calculations filter through immense quantities of factors, searching for mixes that dependably anticipate results. In one sense, this procedure is like that of conventional relapse models: there is a result, covariates, and a factual capacity connecting the two. Be that as it may, where Machine-Learning sparkles is in dealing with huge quantities of indicators — some of the time, strikingly, a larger number of indicators than perceptions — and joining them in nonlinear and exceedingly intuitive ways [15]. The combination of big data and machine learning algorithms are used to develop a

perfect system for health care applications. These systems are able to diagnoses, predict and cure the diseases[9].

In today society smart phones are available every. Almost every person knows how to operate smart phone. The scientists do a lot of work on smart phone health care applications by using big data. These application are easy to

use and help to save many lives[2], [10].

Especially, Big-data investigation in medication and human services empowers examination of the enormous datasets from a huge number of patients, distinguishing clusters and relationship between datasets, just as creating prescient models utilizing information mining strategies [14].
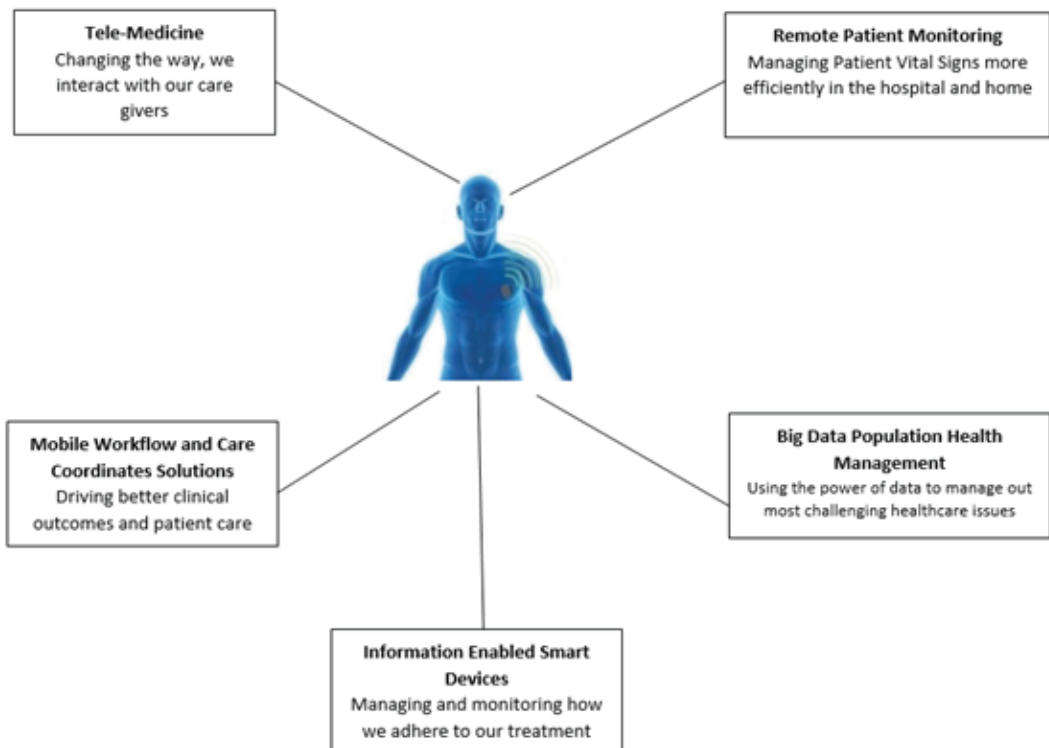
Tele-Medicine
Changing the way, we interact with our care givers

Remote Patient Monitoring
Managing Patient Vital Signs more efficiently in the hospital and home

Mobile Workflow and Care Coordinates Solutions
Driving better clinical outcomes and patient care

Big Data Population Health Management
Using the power of data to manage out most challenging healthcare issues

Information Enabled Smart Devices
Managing and monitoring how we adhere to our treatment

Figure 3: Big data technology in health care system

4.   Challenges

Big data and medical information base big data is two different things. Medical base big data are more complex and hard to maintain[11]. A few of challenge which are occur during implantation of big data techniques on health care application are as following.

4.1. Confidentiality

The security of medical big data is very sensitive issue. It's very important to secure medical data base from cybercrime, phishing and hacking[12]. Because these kinds of databases also contain personal information like credit card history, personal address phone number etc. Appropriation of big-data in social insurance, fundamentally increments security and patient protection concerns. At the beginning,

understanding data is put away in data-centers with changing degrees of security [17].

4.2. Access

The main challenge for medical big data scientist is access of data. To create medical big data datasets scientist needs huge amount of internal and external data of different hospitals and clinics. But the organizations are not ready sharing their customer information with third party because consumers have legal right to in case of unethical handling of his data.

4.3. Data Classification

Medical big data is consist of huge amount of heterogeneous and less structured data[13]. So, data scientists analyze and visualized the data and make the classification of according to their requirements. Clinical databases store a lot of data about patients. Data-mining strategies connected on these databases endeavor to find connections and examples among clinical what's more, obsessive information to comprehend the movement and highlights of specific sicknesses. The achieved information can be utilized for early determination. In the clinical databases, infection cases are genuinely uncommon as contrasted and the ordinary populaces [18].

4.4. Data Modeling

For the best results it is very important that the medical dataset only contain relevant and accurate information. The data modeling for extracting correct information from medical big dataset is a challenging job. Data Modeling is the way to describe the database models and describing or specifying the use of database structures [19]. Today the dominating technology is Relational-DB since 80's [20].

4.5. Storage

The size of medical big data datasets are intera byte and zettabyte. It is compulsory to have enough storage space to upload or generate the data at some time. The storage devices have ability to store word documents, X-ray MRI and CT scan reports.

4.6. Communication

The communication between user and scientist is very important. The communication between scientist and big data collector and end user create a great problem. Because of this gap big data collector is not able to collect accurate information which leads to bed analysis of big data algorithms. This bed analysis caused the great loss of end user in health care application.

4.7. Data Nature

In medical big data datasets play a vital role. The medical big data datasets must contain information of healthcare system and outside the healthcare system. The main problem is that hospital and clinics only contain unhealthy person's data but in big data techniques health individual's information is also required.

5. Benefits

In health care system big data techniques are applications play a vital role to improve the health quality. Medical big data datasets provide many benefits a few of them are as following.

5.1. Patient care

Big data datasets are used to design electronic health care systems. These systems are helpful to do the statistical analysis of patient body.

These statistical figures are leads toward right treatment.

5.2. Operational efficiency

The big data application smart applications are assisting to the hospital staff in the management. These applications are assisting the doctors toward the correct disease diagnostician process, correct and right amount of medicine prescription. All these things play a role in the enhancement of the medical offices and medical researcher's performances.

5.3. Finding a cure

The pharmaceutical companies examine the analysis the medical big data datasets to find the cure of dieses. The big companies spend a lot of money for this purpose for example a few years back the scientist create the world largest database of DNA because they think that this help them out to learn about the dieses nature and cure of disease.

5.4. Prediction

The medical bigdata datasets contain the information of some pervious patient record and healthy people records. This information is helpful to analyze the health condition of a normal human being. Because of these kind analyses the doctors can diagnosis the diseases on time and also able to stop the cause which lead the patient to death. These types of applications are best for heart and blood cancer patient.

5.5. Reduce cost and time

Now the scientists can create and store the large database because of bigdata techniques. These databases are helpful in the analysis of blood samples and another statistical test.

Which are used to diagnosis the dieses. So, by using these databases

Conclusion

Big data algorithm can be game changes in health care system as it has potential to identify different kind of diseases. But it is not an easy task for big data scientist. This review article is about the challenges and opportunities of big data. The size of medical datasets is in zetta byte so the storage of data in medical big data applications are the main issue. Scientist also face some other challenges like data collection, classification and security but the advantage of medical big data is force them to play with these challenges.

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