TECHNOLOGY IN THE COURTS:
FROM STORING AND GENERATING INFORMATION TO EVALUATION OF EVIDENCE

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ABSTRACT
The present study intended to explore the various uses of modern technology in the courts and to advance the argument that the courts should use the literature produced in artificial intelligence and law to reasoning with judicial evidence. After deploying doctrinal research methodology, the present study found that the courts across the world used modern technology to store, process, generate and analyze judicial data. The current study also found that the use of modern technology in the courts resulted in improvement in communicating, storing, generating, processing, and analyzing the day to day judicial data. However, the present study found that the courts across the world in general and Pakistani courts in particular did not pay attention towards using the computer soft wares to reasoning with evidence. The present study argued that the Pakistani courts should use the literature produced in artificial intelligence and law to organize, display and reasoning with judicial evidence. It is expected that the present study will contribute in realizing the potential benefits of modern technology to reasoning with evidence which will improve the courts' performance.
Keywords: Reasoning with Evidence, Modern Technology, Bayesian Networks, Artificial Intelligence and Law.

1. INTRODUCTION
The term "technology" is not only the most frequently used word but also most confusing (Agar, 2020). Generally, the word "technology" refers to utilizing scientific knowledge in a pragmatic manner to accomplish various tasks. Every technology has two components; physical component and informational component. The physical components include products, tooling, equipment, blueprints, techniques, and processes. Similarly, the informational components include the reliability of technology and its functional areas (Kumar et. al, 1999). In judicial settings, technology has frequently been regarded as interchangeable with extensive computer systems that retain caseload information and generate administrative analyses and legal documents. Historically, court record management has been a basis of the judicial process, ensuring the preservation and availability of significant legal information. Traditional practices for maintaining and generating court records have primarily revolved around paper-based systems. These systems have typically involved meticulous handwritten or typed records, which are then manually filed and stored for future reference (Jackson, 1978). Such physical systems necessitate extensive storage space and careful cataloging, with court clerks and administrators responsible for the creation, organization, and retrieval of these records (Jefferson, 1981).

Traditionally, the legal system relied on manual record-keeping methods for storing and generating data. Paper-based systems were prevalent, requiring physical storage space and extensive manual labor for document management (Smith, 2010). These systems involved the use of paper files, filing cabinets, and

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document indexes, leading to significant challenges in terms of organization, retrieval, and preservation of data (Barringer & Schellenberg, 2012). Additionally, manual data generation involved the time-consuming process of transcribing and duplicating documents, leading to potential errors and delays in case proceedings (Hagan, 2018). The limitations of these traditional methods became apparent as the legal system faced increasing caseloads and the need for more efficient and reliable data management solutions (Ferguson, 2016). The court records are significant since they serve as the official memory of the court, documenting proceedings, decisions, and other judicial actions (Sprehe, 1995). Court records also contribute to maintaining transparency and accountability in the legal system, acting as public evidence of judicial actions and providing a means for review and appeal (Smith, 1991). They have also been integral in legal research, providing valuable primary resources for understanding legal principles and precedents (Posner, 1991).

However, traditional practices of court record management have not been without their challenges. The durability and longevity of paper-based records have been a concern, given the risk of physical damage, degradation over time, and loss due to natural disasters or other unforeseen circumstances (Shepard, 1995). Due to these challenges, the courts have implemented technological advancements to establish a comprehensive record of cases (Loftus, 1975). Historically, the judicial system has been relatively unaffected by the advancements of the technological revolution until the near past. According to Lieberman (1976), a certain group of technology advocates has expressed that the contemporary practice of law in the majority of courtrooms is comparable to the practice of surgery in a barber shop. The development of applications was conducted in accordance with a regulatory framework, which facilitated the enhancement of the work performed by all stakeholders in the judicial domain. Consequently, this led to an improvement in the overall functioning of the justice administration system. In certain regions, the utilization of technological tools to align with procedural intricacies has been facilitated by legal measures (Fabri, 2009). Furthermore, technology serves to augment the capacity of legal practitioners to explicate intricate evidence, thereby facilitating the comprehension of said evidence by both jurors and judges (Lederer, 1998).

The Pakistani courts are not exceptions to the exposure of new technologies and they are using computers, internet, emails, SMS, printers and video conferences for various purposes. However, there is paucity of research on the various types of instruments based on modern technology which the courts in developing and developed countries are using. Further to that, the Pakistani courts are ignorant regarding how the research produced in the artificial intelligence and law may be used to reasoning with judicial evidence. The present study intends to fill these gaps in the literature by addressing two research questions; what are the various technologies being used in the courts around the world? How can technology be used to evaluate judicial evidence? The present study has four sections other than the introductory section. The second section reviews the literature, the third section describes the methodology, the fourth section discusses and illustrates how modern technology may be used to evaluate judicial evidence and the last section concludes the study.

2. METHODOLOGY
The researchers of the present study deployed doctrinal research methodology to address the two research questions mentioned in the above section. After coining the research questions and determining the scope of the study, the researchers collected the data from secondary sources. The secondary data was derived from the literature review of numerous sources including journals articles, books, theses and desertions to address the research questions.

3. REVIEW OF THE LITERATURE: TECHNOLOGY IN THE COURTS
This section addresses the first research question of the present study by discussing various uses of technology in the courts around the globe.

The new technology has been used in various jurisdictions as a handy tool to manage and support the various judicial and non-judicial operational tasks since the court administration is concerned with the management of the non-judicial activities of the courts (Meyer, 1971). Courts have traditionally used technology to enhance their internal operations (Greacen, 2019). The new technology has been used in the

courts to execute the daily tasks apart from managing and analyzing the information about filed cases. Various researchers have pointed out and suggested the courts to use technology to perform its day to day functions. For instance, Nihan and Wheeler (1981) discussed three types of technologies which may be used by the courts; task technology, video technology and transcription technology. According to their perspective, task technology possesses the capability to furnish the courts with information in a more efficient manner compared to alternative methods. For example, the utilization of word processing and electronic mailing facilitates the expeditious creation of documents, the summoning of witnesses or parties involved, and accelerates the transmission of case-related documents to judges located in distant geographical areas for examination.

Similarly, the videos technology can make it possible that testimony of busy or remote witnesses may be recorded without unnecessary delay. In a similar vein, transcription technologies play a crucial role in expediting the creation of transcripts, thereby aiding appellate courts in expediting the decision-making process. This is particularly beneficial in cases where the court would otherwise be compelled to delay arguments until the transcripts are prepared. Likewise, Wiggins (2003) noticed different types of modern technologies which are being used in United States of America and these include presentation and recording of evidence through videos films and videos conferencing. Similarly, Merges (1983) has highlighted that creation of electronic funds transfer networks which has left deep effects on the regulation of the banking industry (Merges, 1983).

In a similar vein, Nihan and Wheeler (1981) highlighted the utilization of technology in streamlining the generation of budgetary, personnel, and property-inventory information for courts, much like its application in other intricate organizational settings. The authors also proposed that the utilization of technology has the potential to greatly enhance judges' and their staffs' capacity to conduct legal research, locate relevant ongoing research in other judicial chambers, and facilitate the scheduling of appellate hearings. On the same line of reasoning, the new technology especially the computer technology is being used in the courts for judicial research and planning. The technology is assisting the courts in this task in various ways. For example, proficient management may necessitate familiarity with every item within the court's inventory, including a comprehensive roster of probationers and the diverse levels of oversight that each one necessitates. In this context, a representative subset of such data is frequently sufficient for a planner, whose objective might involve approximating the quantity of individuals that a probation office will supervise within a specified timeframe. The computer technology greatly assists the courts in this task. Several scholars from different jurisdictions have emphasized the use of innovative technology, specifically computer technology, for the purpose of filing cases and appeals. It is noteworthy to acknowledge that an e-filing system serves as a medium through which legal professionals or individuals without legal training can electronically submit documents to the courts, make payments for court fees, and receive notifications online, all facilitated by the use of computers (Contini and Fabri, 2003).

For instance, Brooke's (2003) research pointed out that e-filing has been proved very beneficial in the world in general and in Australia in particular. The practice of electronically filing of cases is so successful in these countries that the researchers predict that it will be followed in America since it involves minimum amount of human intervention subject to the provision of proper training and assistance to the parties not having adequate information about using computers to file their cases electronically (Dixon, 2013). E-filing encompasses more than just the submission of legal cases; it also encompasses the electronic transmission of summonses or notifications from the court to the involved parties, as well as among the parties themselves. Additionally, e-filing involves the electronic submission of documents, whether or not they possess legal validity, and the automated uploading of electronically transmitted data by the parties within the court system. Furthermore, e-filing facilitates online access to these documents and enables the online payment of court fees (Contini and Fabri, 2003). In a similar vein, it is worth noting that electronic filing has become a compulsory practice in Singapore. To navigate the demands of the electronic courthouse, individuals representing themselves in legal proceedings, as well as small firms, often rely on specialized bureaus established specifically to assist them in meeting these demands. Similarly, the utilization of contemporary technology in Israeli courts is examined by Reichman, Sagy, and Balaban (2019).

They pointed out that the utilization of e-live streaming in Israel is a medium to promote transparency and facilitate comprehensive access to the judicial system. They added that the activities of judges, with the exception of those serving on the Supreme Court, are conducted exclusively through Legal-Net, a comprehensive digital platform accessible online. They highlighted that the e-streaming serves as the primary platform for the engagement of litigants, attorneys, court secretariats, judges, and court administrators at every stage of the judicial proceedings. Similarly, Ashdown, & Menzel (2002) point out that the courts are now using computers for virtual hearing of the parties and witnesses. They believe that the virtual hearing will make the judicial process easy and speedy especially for the hearing of judges, lawyers, parties, accused and witnesses residing in remote areas. Further to that Dixon (2013) describes the merits and demerits of video hearing. He holds the view that the use of virtual hearing is not without criticism, however, its use is necessary to avoid an undesired delay in the proceeding.

On the other hand, Carboni, & Velicogna (2011) discuss the use of new technology for automation of Summons. They highlight that the courts are heavily relying upon the modern technology to automate the previously generated human activities in the courts to ensure the accountability of whole process. According to Carboni and Velicogna (2011), judicial proceedings involve the regulated exchange of information, which is necessary for presenting the relevant facts to the judge who is tasked with making a decision. Similarly, Contini (2020) asserts that automation is a prominent outcome of the digital transformation. Computer programs, equipped with their user interfaces and modules for data processing, have the capability to automate certain tasks, such as the issuance of summons, which were traditionally carried out by human individuals. Similarly, Wiggins, & Breckler, (1992) examine the use of modern technology to produce specific digital evidence in the courts by way of animation and simulation. The production of evidence in this way is significant since the understanding and interpretation of such evidence is beyond the ordinary capacity of the judges. They point out that the American judges address this issue by adjusting the suboptimal environments under which judges have conventionally functioned.in addition, they believe that the modern technology will make it possible for judges to discuss evidence with their fellow judges in other parts of the world.

Likewise, numerous researchers explored, observed and suggested the use of modern technology in the Pakistani courts. For instance, Khan and Ali (2021) explored the possibility of the establishment of E-courts in the existing legal framework and the areas where modern technology might be used in the backdrop of the alternative dispute resolution. They found that the establishment of the E-court system is in line with the existing legal framework of Pakistan. They also proposed to start using modern technology for e-filing and case-flow management system. Similarly, Saeed & Gilani (2021) explored the production of evidence through modern devices. They found that the Pakistani courts are allowing using the evidence procured through modern devices like press reports, press clips, fax, email and internet, cell phones, computers, audio or videos recordings, photographs, screenshots, and polygraph and DNA test. On the other hand, Cheema (2016) analyzed the difficulties in production, admissibility and evaluation of DNA evidence at the investigation and trial stage. He pointed out that the Pakistani courts' reluctance to use DNA evidence in the cases involving the question of legitimacy due to conclusive presumption attached with legitimacy which has undermined the significance of this strong evidence. He also pointed out that the courts treated DNA evidence as expert opinion in sexual offences which has also lessoned the importance of this evidence. On the same line of reasoning, Shafiq, Shafiq and Sarwar (2022) suggested the use of artificial intelligence in Pakistani courts to respond to complaints timely, collect or structure data about attorneys, cases and courts, and to keep the record of the decided or pending cases. Furthermore, Sharafat, Nasar and Jaffry (2019) conducted experimental study using the civil cases decided by the Lahore high court to explore the possibility of automatic information extraction from legal data in Pakistan.

The above discussion indicates that the courts are using broad range of technologies which are either input or output of the judicial process. The various types of technologies as discussed above include electronic forms, case management systems, e-justice platforms, printers, keyboards, computers performing generic functions and other technological component that registers, processes, guides and executes procedures. These modern devices are intended to depict, investigate, deduce, and scrutinize differing conjectures and substantiation that may emerge throughout the litigation of a legal matter (Levitt & Laskey,

2000). The various types of technology used in the courts are providing managerial and operational support to the courts to discharge their daily tasks. Moreover, the judges use modern technology as helping tool which does not require any legal sanction. The devices based on modern technology are just a mean to ease and speed the judicial process. Likewise, technology has also been used to procure evidence which was not available in the past; however, such evidence may be used if rules of procedure or proof allow. However, it is worth noticing that the modern technology in the form of soft wears to organize and evaluate judicial evidence is not used in Pakistan. The following section discusses and illustrates that how the courts may use modern technology to reason with evidence.

4. MODERN TECHNOLOGY AND EVALUATION OF JUDICIAL EVIDENCE

This section addresses the second research question of the present study by developing the arguments that the research carried out in artificial intelligence and law can be used to organize and evaluate judicial evidence. The present section argues that the Bayesian probability in networks and object-oriented form can be used manually as well as through computers soft wares to reasoning with judicial evidence.

A. Bayesian Networks

The complicated structure of judicial evidence and the inherent uncertainties associated with it are the typical features of legal evidence. The judges interpret the pattern of evidence which involves numerous variables and joining different pieces of evidence in a complicated framework. The complicated nature of the evidential framework requires a logical approach to organize and evaluate judicial evidence (Bex et al. 2003). Bayesian network is one of the tools to organize and evaluate judicial evidence. The present section introduces and illustrates the Bayesian networks to reasoning with judicial evidence. The Bayesian networks are the graphical methods of organizing, representing and evaluating the judicial evidence that calculate complex joint probability distributions (Pearl, 1988, Halpern, 2003). The utilization of Bayesian networks as a means of conducting probabilistic reasoning in the context of legal cases has been the subject of scholarly investigation (Keppens, 2011). These networks are a broad statistical tool that may be utilized in the context of a legal system to model the links between the various sources of evidence, evaluate the evidence that is available, and draw conclusions from evidence (Cowell et al., 2007). The graphical structure in the Bayesian networks demonstrate (in)dependencies between the variables in a case. The graph in the Bayesian networks contains various nodes to handle the legal evidence namely the hypothesis nodes, and the evidence nodes. When the nods are connected with each other with arrows, it shows that there is some probabilistic dependency between the variables (for example, between 'suspect X left a fingerprint' and 'a fingerprint match was found with suspect X') (Vlek et all, 2013). In addition, the arrows between different variables are generally drawn from cause to effect (Taroni et all, 2006), but represent correlation rather than causality (Dawid, 2010). The Bayesian networks may be used in a number of ways to handle judicial evidence and the followings paragraph introduces and illustrate how these may be used in idiom based approach.

Lagnadoa, Fenton and Neil, (2013) offered an idiom based approach to organize and evaluate judicial evidence. In the idiom based approach, extensive inferential issues are disintegrated into smaller components which are like common inferential schema. These inferential schemas are termed as idioms which are the basic building blocks to structure intricate multi-variable problems. In the judicial context, these idioms are structured and built to the constraints and demands of legal enquiry focusing on the motive, opportunity, and the assessment of the reliability and veracity of eyewitnesses' testimony (Lagnadoa, Fentonb and Neil, 2013, p. 50). However, the literature discloses that idioms may be general or specific and a brief discussion is offered in the following paragraphs on the general and specific idioms.

The basic form of general idioms is the evidence idioms which depicts a specific relation between a hypothesis and an item of evidence. A hypothesis, in a legal context, is a proposition relevant to the case, either directly such as whether the accused committed the crime in question (ultimate proposition), or indirectly relevant to ultimate proposition such as motive or opportunity. On the other hand, evidence is typically an observation, statement or report presented in court that shows link from evidence to hypothesis. For instance, Lagnadoa, Fentonb and Neil (2013) illustrate it with a legal example. They postulated that a pivotal hypothesis in a case of robbery is the assertion that the suspect is responsible for the commission of the crime, a statement that can be evaluated as either true or false. If this proposition is indeed valid, it could

serve as a plausible explanation for the identification evidence provided by the victim. From a probabilistic standpoint, the veracity of this hypothesis would increase the likelihood of a positive identification report, while the falsehood of this hypothesis would decrease the likelihood of a positive identification report. On the contrary, employing Bayes' rule, a positive identification report increases the likelihood that the suspect is responsible for the crime, while a negative identification report decreases the probability of the suspect's involvement in the crime. The authors emphasize that probabilistic inferences can occur in both directions, from causes to effects and from effects to causes. However, the Bayesian network representation is designed to capture the assumed causal direction in the real world, where the hypothesis (cause) leads to the evidence (effect) (p. 50). The general idioms encompass a wide range of evidentiary idioms that establish a connection between evidence and hypothesis.

On the other hand, the specific idioms are those idioms which capture and represent a specific relationship between evidence and hypothesis. These idioms may be reliability and specific situation idioms. The evidence-reliability idioms explicitly acknowledge the fallibility of evidence and recognize the existence of additional causal factors that may impact its production and human testimony presents added intricacy due to the possibility of witnesses being incentivized to engage in deceitful behavior (Lagnadoa, Fentonb and Neil, 2013). Evidence reliability idioms are represented by an additional node in the Bayesian networks that serve as a moderator in determining the degree of belief in evidence to represent the actual state of the hypothesis. The additional nodes related to reliability idioms in Bayesian networks are of two types; parent nodes, which represent causative variables, and child nodes, which represent effects. It is significant to point out that the notion of reliability is multifaceted, and there exist various manners in which a source of evidence may lack reliability. According to Schum's (1994) framework, reliability can be broken down into three distinct components, namely: (i) observational sensitivity, which pertains to the accuracy of the measurement, (ii) objectivity, which refers to the degree to which the measurement is free from bias, and (iii) veracity, which concerns the consistency and stability of the measurement over time.

The concept of observational sensitivity is applicable to both human and mechanical measurement devices. The sensitivity of human testimony is frequently contingent upon various factors, including but not limited to the conditions under which the observation occurred, the perceptual abilities of the observer, and the level of expertise possessed by the observer. There exist certain factors that could potentially impact the efficacy of the witnesses' encoding of the crime incident. Additionally, various factors could influence the victim's ability to recollect this information when tasked with identifying the perpetrator during an identification parade. Likewise, the concept of objectivity pertains to the cognitive process of forming beliefs, as opposed to solely relying on sensory perception. The differential factor between observational sensitivity and the aforementioned phenomenon lies in the potential presence of a systematic bias in the cognitive process of the observer, irrespective of the degree of sensitivity of their perceptual faculties. It is plausible that a witness may exhibit an over-interpretation of sensory information as a result of robust preconceived notions or a particular response bias. It is noteworthy that the absence of objectivity is not a form of deception. Rather, it is a manifestation of the cognitive process of belief formation in the observer, and the impact of contextual factors. The objectivity issue is not limited to eyewitnesses instead; expert witnesses are also prone to such issue. For instance, Dror and Charlton's study (2006) revealed that external information, which is not directly pertinent to the match judgment, can influence the decision-making of fingerprint experts and lead to bias.

The concept of veracity or truthfulness is arguably the most salient matter brought forth by witness testimony, particularly in cases where the witness has a vested interest in the legal proceedings' outcome. The relevance of questioning the veracity of a witness becomes particularly salient in cases where the accused individual, or an individual with a vested interest in the accused, is offering testimony. The reason why alibi evidence provided by a close relative or friend is often viewed with skepticism, if not complete incredulity, is elucidated by Gooderson (1977). The issue of truthfulness is commonly considered to be distinct from the remaining two origins of imprecision. The honesty of a witness is not contingent upon their level of observational sensitivity or objectivity. A thorough model of reliability incorporates all three distinct components of reliability. In the context of Bayesian network idiom, every constituent is depicted as an individual parent node of the evidential account. According to Lagnadoa, Fenton and Neil (2013), the

concept of reliability may not necessarily require an analysis of all three variables, as it may be sufficient to focus on one or two of these variables. The authors employ a hypothetical scenario to demonstrate their point, wherein they make the assumption that the individual in question can be classified as reliable or unreliable, denoted by the Boolean variable "Reliable" being assigned either a true or false value. The authors included information regarding four possible scenarios: (i) the suspect committed the crime and the victim's testimony is reliable, (ii) the suspect did not commit the crime and the victim's testimony is reliable, (iii) the suspect committed the crime and the victim's testimony is unreliable, and (iv) the suspect did not commit the crime and the victim's testimony is unreliable. The examination of the likelihood of testimonial evidence is necessary for the four hypothetical scenarios presented. Based on logical reasoning, certain assumptions can be made. Assuming the victim's credibility, it can be posited that a positive report will be given in the event that the hypothesis is accurate ($P(E|H\&R) = 1$), while a negative report will be provided if the hypothesis is incorrect ($P(E|H\&R) = 0$). In the event that the victim lacks credibility, it can be postulated that their testimony remains unaffected by the culpability or innocence of the accused party. The conditional probability $P(E|H\&R) = P(E| H\&R) = 0.5.1$ can be straightforwardly assigned.

Like reliability idioms, various researchers have developed specific situational idioms in Bayesian networks to organize and evaluate evidence related to specific situations. For instance, Lagnadoa, Fentonb and Neil (2013) have developed opportunity and motive idioms and Neil et al. (2000) propose five specific idioms. To them, majority of crimes are commonly believed to be preceded by opportunity and motive. Opportunity is a necessary condition for establishing culpability in specific cases like assault, rape, burglary, and homicide. If an accused establishes the fact that he did not have the opportunity to commit the crime, it logically follows that he could not have perpetrated the crime. Similarly, motive is frequently a pivotal aspect of the prosecution's case against the defendant though it is not an essential requirement for convicting an accused. Lagnadoa, Fentonb and Neil (2013) believe that, from a Bayesian Network (BN) standpoint, both opportunity and motive serve as causal prerequisites for guilt. They add that opportunity and motive must be represented as parent variables to the primary crime hypothesis. They also believe that it is imperative to distinguish hypotheses pertaining to motive or opportunity from the evidence presented to corroborate or refute said hypotheses. The veracity of this evidence may be subject to inquiries regarding its dependability. Similarly, Neil et al. (2000) presented five idioms that cover a wide range of modeling tasks. The first idiom is the cause-consequence idiom that serves to represent the ambiguity inherent in a causal mechanism that produces observable effects. This idiom is utilized to represent a particular procedure by means of the correlation between its causative elements (i.e. the events or facts that serve as inputs to the procedure) and its resultant factors (i.e. the events or factors that serve as outputs of the procedure). The cause and effect idiom is structured in a chronological manner, where the parent nodes, which are the inputs, are typically positioned prior to or at the same time as the children nodes, which are the outputs. The second specific idiom introduced by them is the measurement idiom that represents the imprecision associated with the precision of a given measurement. The measurement idiom is utilized to denote the inherent uncertainties that are associated with the process of observation which means ascertaining the genuine attribute, condition, or feature of a given entity. The definitional idiom is the third idiom which is a method that represents the arrangement of multiple uncertain variables that collectively establish a functional, taxonomic, or otherwise deterministic association. The fourth idiom is the induction idiom that is a statistical model that accounts for the uncertainty inherent in inductive reasoning when dealing with populations consisting of similar or exchangeable members. The last idiom is the reconciliation idiom that represents the process of reconciling outcomes obtained from different measurement or prediction systems that are in competition with each other.

B. Object-Oriented Approach

Hepler, Dawid, and Leucari (2007) introduce object-oriented Bayesian networks that enable the hierarchical assembly of small modular networks, or network fragments, as fundamental components. It is important to note that the application of object-oriented methods will require the availability of suitable software and they cannot be performed manually. The noteworthy aspect of their methodology pertains to their proposal to scrutinize legal evidence through the creation of individual modules for each piece of evidence, as opposed to generating a comprehensive module all at once. The module adheres to a high-level network,

which greatly streamlines the modeling procedure. This architecture enables a top-down methodology, wherein the specifications of lower-level modules need not be explicitly defined at the outset. The approach under consideration is noteworthy for its examination of the qualitative characteristics of Bayesian networks, which serve as a graphical mechanism for organizing substantial amounts of evidence. In their proposal, the Bayesian network's graphical structure comprises of nodes that symbolize pertinent hypotheses, evidence items, and latent variables. The arrows that establish a connection between these nodes indicate a probabilistic dependency. It is important to point out that their module contains five pattern of evidence including recurrent pattern of identification of accused, contradictions, corroborations, conflict, convergence, and explaining away.

5. DISCUSSION

The two approaches to handle and evaluate judicial evidence discussed in this section have certain merits which make them suitable to marshal and draw inferences from judicial evidence. The idiom based approach is significant as it not only enable a judge to take a holistic view of the whole evidence but also guides him how to take an atomistic view of the evidence. The general evidence idioms are helpful in organizing and assessing the whole evidence whereas the specific evidentiary idioms assist a decision maker to organize and evaluate specific evidence related to specific events in a criminal cases. In addition, the evidence reliability idioms offer a concrete and reliable framework to assess the reliability of both oral and documentary evidence. Further to that, the breaking down of reliability of evidence into smaller units makes it possible that the truthfulness of any piece of evidence is scrutinized to the grass root level which will exclude any possibility of error and deception. Likewise, idiom based approach enable judges to employ generic inference patterns, thereby facilitating the drawing of principled inferences. The most significant characteristic of idiom based approach is that it may be used manually if the courts are not equipped with appropriate computer soft wares. Similarly, object oriented approach is significant since it does not incorporate the whole evidence in one diagram; instead it construct recurrent pattern of evidence. In addition, the diagram can be edited when needed. Similarly, it has simplified the display of complicated networking of judicial evidence. It is highly appropriate for evidence analysis since it involves observing particular evidential patterns which are used iteratively, both intra- and inter-case. Furthermore, the approach pays special attention towards the evaluation of eyewitnesses' testimony which is frequently used in criminal proceedings. The utilization may enable a judge to construct a comprehensive fundamental network that models eyewitness testimony. This module may subsequently be employed in the primary network and/or in subsequent networks, with possible adjustments. The noteworthy aspect of their methodology pertains to their proposal to scrutinize legal evidence through the creation of individual modules for each piece of evidence, as opposed to generating a comprehensive module all at once. However, the major limitation associated with object-oriented approach is that it can only be used with soft wares. Further to that, both idiom based and object oriented approaches involve the quantitative analysis of evidence which make them difficult to understand and apply by judges in judicial trials. The discussion reveals that the idiom based approach and object-oriented approach have certain features which make it feasible that these can be used to handle judicial evidence manually or by using software.

6. CONCLUSIONS

The present study provides a discussion from which the following seven major conclusions can be inferred. First, technology has provided managerial and operational assistance, thereby facilitating courts to manage their caseloads more effectively, especially in light of their amplified size and intricacy. Secondly, the implementation of automation can expedite the completion of routine duties of the courts and enhance the quantity of pertinent data at the disposal of a judicial body. Third, the application of new technology in the courts holds the capacity to induce significant modifications within the current legal structure. Four, the Pakistani courts have used technology to manage their supplementary task and they have not deliberated on using the new technology and their technical underpinning to reasoning with evidence. Five, the utilization of the literature in artificial intelligence and law can facilitate the courts to organize, display, assess and evaluate the evidence. Six, It is imperative to investigate the possibility of qualitative

probabilistic networks without the requirement of assigning numerical probabilities as suggested by Wellman & Henrion (1993). Lastly, it is imperative for the courts to consider utilizing the diverse range of software applications that have been developed in the field of artificial intelligence and law, in order to effectively manage and assess judicial evidence.

REFERENCES

Agar, J. (2020). What is technology? Technology: critical history of a concept, by Eric Schatzberg, Chicago and London, University of Chicago Press, 2018, 352. *Annals of Science*, *77*(3), 377-382.

Ashdown, G. G., & Menzel, M. A. (2002). The convenience of the guillotine: Video proceedings in federal prosecutions. *Denv. UL Rev.*, *80*, 63.

Barringer, M. W., & Schellenberg, T. R. (2012). The state of record-keeping in the United States: A survey of government agencies. The American Archivist, 75(2), 368-405.

Brooke, H. (2003). The legal and policy implications of courtroom technology: the emerging English experience. *Wm. & Mary Bill Rts. J.*, *12*, 699.

Carboni, N., & Velicogna, M. (2011). Electronic data exchange within European Justice: e-CODEX challenges, threats and opportunities. In *IJCA* (Vol. 4, p. 104).

Cheema, S. A. (2016). DNA evidence in Pakistani courts: An analysis. *LUMS LJ*, *3*, 1.

Contini, F. (2020). Artificial intelligence and the transformation of humans, law and technology interactions in judicial proceedings. *Law, Tech. & Hum.*, *2*, 4.

Contini, F., & Fabri, M. (Eds.). (2003). *Judicial Electronic Data Interchange in Europe: Applications, Policies and Trends: Research Project with Financial Support from the Grotius Civil Programme and Grotius 2.(Criminal), European Commission, and from the Italian Ministry of Education, University and Research (FIRB Programme)*. Lo scarabeo.

Cowell, R. G., Dawid, P., Lauritzen, S. L., & Spiegelhalter, D. J. (2007). *Probabilistic networks and expert systems: Exact computational methods for Bayesian networks*. Springer Science & Business Media.

Dawid, A. P. (2010, February). Beware of the DAG!. In *Causality: objectives and assessment* (pp. 59-86). PMLR.

Dixon Jr, H. B. (2013). Technology and the courts: A futurist view. *Judges J.*, *52*, 36.

Dror, I. E., Charlton, D., & Péron, A. E. (2006). Contextual information renders experts vulnerable to making erroneous identifications. *Forensic science international*, *156*(1), 74-78.

Fabri, M. (2009). E-justice in Finland and in Italy: Enabling versus Constraining Models. *ICT and innovation in the public sector: European studies in the making of e-government*, 115-146.

Ferguson, J. L. (2016). Technology in the courtroom: A comparison of current and upcoming technologies. Journal of Court Innovation, 9(2), 183-209.

Gooderson, R. N. (1977). Phipson on Evidence. Edited by John Huxley Buzzard, a Circuit Judge at the Central Criminal Court and a Master of the Bench of the Inner Temple, Richard May, ba, ll. b., of the Inner Temple and South-Eastern Circuit, Barrister, and MN Howard, ma, bcl, of Gray's Inn and the South-Eastern Circuit, Barrister.[London: Sweet & Maxwell Ltd. 1976. cxciii, 955 and (Index) 58 pp.£ 2500 net.]. *The Cambridge Law Journal*, *36*(2), 399-400.

Greacen, J. M. (2019). Eighteen ways courts should use technology to better serve their customers. *Family Court Review*, *57*(4), 515-538.

Hagan, J. (2018). The legal system in operation: Courts, jurisprudence, and constitutional law. Routledge.

Halpern, J. Y. (2003). Reasoning about Uncertainty (Cambridge, Ms.

Hepler, A. B., Dawid, A. P., & Leucari, V. (2007). Object-oriented graphical representations of complex patterns of evidence. *Law, Probability & Risk*, *6*(1-4), 275-293.

Hepler, A. B., Dawid, A. P., & Leucari, V. (2007). Object-oriented graphical representations of complex patterns of evidence. *Law, Probability & Risk*, *6*(1-4), 275-293.

Keppens, (2011). On extracting arguments from Bayesian network representations of evidential reasoning. In *Proceedings of the 13th international conference on artificial intelligence and law* (pp. 141-150).

Keppens, J. (2011, June). On extracting arguments from Bayesian network representations of evidential reasoning. In *Proceedings of the 13th international conference on artificial intelligence and law* (pp. 141-150).

Khan, A., & Ali, A. B. (2021). Electronic Court System and Speedy Justice: A Comparative Critical Analysis of Legal Systems in Pakistan, Malaysia, and India. *JL & Soc. Pol'y*, 26.

Kumar, V., Kumar, U., & Persaud, A. (1999). Building Technological Capability through Importing Technology: TheCase of Indonesian Manufacturing Industry. Journal of Technology Transfer, 24, 81-96.http://dx.doi.org/10.1023/A:1007728921126.

Lagnado, D. A., Fenton, N., & Neil, M. (2013). Legal idioms: a framework for evidential reasoning. *Argument & Computation*, *4*(1), 46-63.

Lederer, F. I. (1998). The Road to the Virtual Courtroom-a Consideration of Today's--And Tomorrow's--High-Technology Courtrooms. *SCL Rev.*, *50*, 799.

Levitt, T. S., & Laskey, K. B. (2000). Computational inference for evidential reasoning in support of judicial proof. *Cardozo L. Rev.*, *22*, 1691.

Lieberman, J. K. (1976). Will the Courts Meet the Challenge of Technology. *Judicature*, *60*, 84.

Loftus, J. J. (1975). The Role of Videotape in the Criminal Court. *Suffolk UL Rev.*, *10*, 1107.

Merges, R. P. (1983). Apple v. Franklin: An Essay on Technology and Judicial Competence. *Yale L. & Pol'y Rev.*, *2*, 62.

Meyer, B. (1971). Court administration: The newest profession. *Duq. L. Rev.*, *10*, 220.

Neil, M., Fenton, N., & Nielson, L. (2000). Building large-scale Bayesian networks. *The Knowledge Engineering Review*, *15*(3), 257-284.

Nihan, C. W., & Wheeler, R. R. (1981). Using Technology to Improve the Administration of Justice in the Federal Courts. *BYU L. Rev.*, 659.

Pearl, J. (1988). *Probabilistic reasoning in intelligent systems: networks of plausible inference*. Morgan kaufmann.

Reichman, A., Sagy, Y., & Balaban, S. (2019). From a panacea to a Panopticon: the use and misuse of technology in the regulation of judges. *Hastings LJ*, *71*, 589.

Saeed, M. A., & Gillani, A. H. (2021). Evidential representation of using the modern devices and decisionmaking feasibility in Pakistan. *Journal of Law & Social Studies*, *3*(2), 79-86.

Shafiq, J., Shafiq, H. M. S., & Sarwar, M. S. (2022). Use of ICTs and Artificial Intelligence to Overcome Judicial Trial Delays in Pakistani Courts. *Pakistan Languages and Humanities Review*, *6*(2), 1153-1163.

Sharafat, S., Nasar, Z., & Jaffry, S. W. (2019). Legal data mining from civil judgments. In *Intelligent Technologies and Applications: First International Conference, INTAP 2018, Bahawalpur, Pakistan, October 23-25, 2018, Revised Selected Papers 1* (pp. 426-436). Springer Singapore.

Smith, S. (2010). The evolution of record-keeping practices. Records Management Journal, 20(1), 14-28.

Taroni, F., Aitken, C. G., Garbolino, P., & Biedermann, A. (2006). *Bayesian networks and probabilistic inference in forensic science* (pp. 1-354). Chichester: Wiley.

Vlek, C., Prakken, H., Renooij, S., & Verheij, B. (2013, June). Modeling crime scenarios in a Bayesian network. In *Proceedings of the fourteenth international conference on artificial intelligence and law* (pp. 150-159).

Vlek, C., Prakken, H., Renooij, S., & Verheij, B. (2013, June). Modeling crime scenarios in a Bayesian network. In Proceedings of the fourteenth international conference on artificial intelligence and law (pp. 150-159).

Wiggins, E. C. (2003). What we know and what we need to know about the effects of courtroom technology. *Wm. & Mary Bill Rts. J.*, *12*, 731.

Wiggins, E. C., & Breckler, S. J. (1992). Management of complex civil litigation. *Handbook of psychology and law*, 77-94.