

# AI Based FIR Filing System

Aniket Chaudhari; Bhavesh Amborkar; Om Deshmukh; Ashwini Bhide; Asmita Kamble  
Department of Computer Engineering, Sinhgad Institute of Technology and Science, Pune

**Abstract:-** In the realm of law enforcement, the accurate and timely filing of First Information Reports (FIRs) stands as a crucial step in the initiation of criminal investigations. However, this process is often fraught with challenges, ranging from the complexity of legal frameworks to the potential for inaccuracies in manual documentation. In recent years, the modernization of law enforcement practices has been propelled by advancements in technology, offering promising solutions to address these challenges. This survey paper aims to provide a comprehensive overview of the landscape of technological solutions designed to enhance FIR filing processes, with a specific focus on their application in law enforcement contexts.

**Keywords:-** First Information Reports (FIRs), Law enforcement, Technological Solutions, Modernization, Criminal Investigations.

## I. INTRODUCTION

The modernization of law enforcement processes has emerged as a pressing necessity in today's dynamic legal landscape, where the timely and accurate filing of First Information Reports (FIRs) serves as a cornerstone in the pursuit of justice. However, the traditional methods employed in FIR filing often prove inadequate in addressing the complexities inherent in contemporary criminal investigations. Law enforcement agencies grapple with the daunting task of navigating intricate legal frameworks, ensuring the precise application of criminal law clauses, and managing the voluminous documentation associated with FIR filing.

In response to these challenges, there has been a notable shift towards the adoption of advanced technological solutions aimed at streamlining and enhancing FIR filing processes. This transition reflects a recognition of the potential of technology to augment the capabilities of law enforcement agencies, improving operational efficiency, and facilitating more effective administration of justice. By leveraging technologies such as Natural Language Processing (NLP), Automatic Speech Recognition (ASR), Machine Learning (ML), Deep Learning (DL), and Convolutional Neural Networks (CNN), law enforcement agencies seek to revolutionize the transcription of audio recordings into actionable FIR documents.

This survey paper endeavours to delve into the multifaceted landscape of technological solutions designed to address the challenges inherent in FIR filing processes. Through a systematic review of existing literature and

research findings, we aim to provide insights into the efficacy, limitations, and future prospects of these technologies in enhancing the efficiency and accuracy of FIR filing. By synthesizing insights from diverse sources, we seek to offer a comprehensive understanding of the state-of-the-art in technological solutions for FIR filing and pave the way for future research endeavours in this critical domain of law enforcement technology.

## II. LITERATURE REVIEW

In recent years, researchers have made significant strides in various domains by leveraging advancements in natural language processing (NLP), data visualization, and machine learning. Here, we delve into key studies that highlight innovative approaches and their potential implications.

One groundbreaking development is Chat2VIS [3], a system that harnesses the power of large language models (LLMs) such as ChatGPT and GPT-3 to directly translate natural language queries into data visualizations. By employing well-engineered prompts, Chat2VIS not only simplifies the NL2VIS process but also automates chart-type selection, all while prioritizing data privacy. However, while Chat2VIS offers streamlined NL2VIS and data privacy benefits, its effectiveness may be limited by the performance and biases of underlying language models, and it may require users to have some understanding of natural language processing concepts.

Transformer-based Neural Architecture Search (NAS) [6] methods have emerged as a promising avenue for automating the design process of neural networks, particularly with models like BERT and Vision Transformers. These techniques aim to yield efficient architectures surpassing manual designs, driving progress in various NLP tasks. However, challenges persist, such as significant computational costs and complexities in implementation and understanding.

The introduction of a novel Transformer-based framework for Scene Text Recognition (STR) [7] represents a significant advancement in NLP. This framework demonstrates superior performance in recognizing scene text of varying complexities, addressing challenges associated with regular and irregular text formats. However, while this framework shows promise, its effectiveness may be limited by resource-intensive computational requirements and complexities in integrating with existing systems.

Researchers have also demonstrated the potential of social media data and pre-trained BERT models from Hugging Face [1] in predicting mental disorder symptoms with remarkable accuracy. By leveraging even small amounts of data like user bios, this approach opens avenues for early mental health screening and intervention. Yet, despite its potential benefits, this approach raises concerns regarding data privacy and ethical implications surrounding the use of personal data for mental health screening.

Government service consultations present a unique challenge in utilizing large language models effectively. To address this, researchers propose a domain-specific language model (GCALLM) [2] fine-tuned with knowledge from government websites, enhancing response accuracy and improving digital government consulting services. However, while GCALLM improves response accuracy, challenges may arise in terms of model generalization to diverse user queries and potential biases introduced during fine-tuning.

Preserving digital information over time is another significant challenge, tackled by a proposed solution involving a simple abstract machine, technology-neutral descriptions, and a C compiler, ensuring interpretation and retrieval of complex digital formats even after prolonged periods [9]. However, while this solution promises long-term preservation of digital information, challenges may arise in terms of adaptability to evolving technologies and formats, as well as resource-intensive implementation requirements.

The evolution of text representation in NLP [4], from rule-based to context-sensitive learned representations, showcases significant progress. While recent advancements have led to breakthroughs in downstream NLP tasks, challenges such as bias, interpretability, and privacy issues underscore the need for continued research.

Addressing location metonymy resolution in NLP [8], researchers propose innovative feature selection approaches achieving remarkable results without complex models or extensive resources, paving the way for more accurate and efficient text processing systems. However, while these approaches show promise, challenges may arise in terms of model scalability and generalization to diverse datasets and linguistic contexts.

In the realm of fairness in Automatic Speech Recognition (ASR) systems, a counterfactual fairness approach is introduced [10] to mitigate bias and ensure equitable outcomes across demographic groups, aiming for fairer and more reliable ASR systems. Yet, despite its potential benefits, challenges may arise in terms of defining appropriate fairness metrics and ensuring their consistent application across diverse ASR applications and user groups.

Finally, the introduction of a multi-teacher knowledge distillation (MT-KD) network for Tacotron2 Text-to-Speech (TTS) [5] models represent a significant advancement in addressing exposure bias, achieving improved naturalness,

robustness, and expressiveness in TTS systems. However, while MT-KD shows promise in mitigating exposure bias, challenges may arise in terms of model scalability and generalization to diverse linguistic contexts and speaking styles.

These studies collectively underscore the interdisciplinary nature of NLP research and its profound impact across various domains. While promising more accessible, reliable, and equitable technologies in the future, addressing the associated challenges remains crucial for realizing their full potential.

### III. FUTURE SCOPE

Moving forward, the integration of advanced technologies and the modernization of FIR filing processes present compelling opportunities for law enforcement. Future endeavours should focus on fostering interoperability and standardization across agencies to facilitate seamless data exchange. Additionally, the development of real-time analytics platforms powered by machine learning holds promise for proactive crime prevention and detection. Embracing interdisciplinary collaboration and innovation will be key to navigating the evolving landscape of law enforcement technology, ensuring ethical deployment, and advancing the mission of justice and public safety in society.

### IV. CONCLUSION

In conclusion, the surveyed literature underscores the potential of technology to modernize FIR filing processes and enhance law enforcement practices. The integration of advanced technological solutions like Natural Language Processing (NLP), Automatic Speech Recognition (ASR), and Machine Learning (ML) presents opportunities for improving the efficiency and accuracy of FIR filing. These technologies offer promising avenues for automating tasks, reducing manual errors, and expediting the initiation of criminal investigations.

To realize this potential, interdisciplinary collaboration and innovation are crucial. Researchers and practitioners from diverse fields such as computer science, law enforcement, and data analytics must work together to develop comprehensive solutions that address the complex challenges of FIR filing. By leveraging expertise from different domains, we can ensure that technological advancements are tailored to the specific needs and contexts of law enforcement agencies.

Future efforts should prioritize interoperability, standardization, and the development of real-time analytics solutions. Interoperability between different systems and agencies will facilitate seamless data exchange and collaboration, enabling more efficient information sharing and coordination in criminal investigations. Standardization of processes and protocols will promote consistency and reliability across different jurisdictions, enhancing the overall effectiveness of law enforcement practices.

Furthermore, the development of real-time analytics solutions powered by machine learning holds significant promise for proactive crime prevention and detection. By analysing large volumes of data in real-time, law enforcement agencies can identify patterns, trends, and anomalies that may indicate criminal activity, enabling them to intervene and respond more effectively. By embracing these principles and fostering innovation, we can advance law enforcement capabilities while ensuring ethical and responsible technology deployment. It is essential to prioritize the protection of individual rights and privacy while harnessing the power of technology to serve the interests of justice and public safety in society.

## REFERENCES

- [1]. Alireza Pourkeyvan, Ramin Safa, and Ali Sorourkhah “*Harnessing the Power of Hugging Face Transformers for Predicting Mental Health Disorders in Social Networks*” 16 February 2024
- [2]. Jiawei Han, Jiankang Lu, Ying Xu, Jin You, And Bingxin Wu “*Intelligent Practices of Large Language Models in Digital Government Services*” 4 January 2024
- [3]. Paula Maddigan and Teo Susnjak “*Chat2VIS: Generating Data Visualizations via Natural Language Using ChatGPT, Codex and GPT-3 Large Language Models*” 8 May 2023.
- [4]. Rajvardhan Patil, Sorio Boit, Venkat Gudivada, And Jagadeesh Nandigam “*A Survey of Text Representation and Embedding Techniques in NLP*” 11 April 2023
- [5]. Rui Liu, Berrak Sisman, Guanglai Gao, and Haizhou Li “*Decoding Knowledge Transfer for Neural Text-to-Speech Training*” published in 2022
- [6]. Krishna Teja Chitty-Venkata, Murali Emani, Venkatram Vishwanath and Arun K. Somani “*Neural Architecture Search for Transformers: A Survey*” 6 October 2022
- [7]. Prabu Selvam1, Joseph Abraham Sundar Koilraj1, Carlos Andrés Tavera Romero, Meshal Alharbi, Abolfazl Mehbodniya, Julian L. Webber and Sudhakar Sengan “*A Transformer-Based Framework for Scene Text Recognition*” 16 September 2022
- [8]. Muhammad Elyas Meguellati, Rohana Binti Mahmud, Sameem Binti Abdul Kareem, Assaad Oussama Zeghina, and Younes Saadi “*Feature Selection for Location Metonymy Using Augmented Bag-of-Words*” 1 August 2022
- [9]. Ivar Rummelhoff, Eladio Gutiérrez, Thor Kristoffersen, Ole Liabø, Bjarte M. Østvold, Oscar Plata, and Sergio Romero “*An Abstract Machine Approach to Preserving Digital Information*” 16 November 2021
- [10]. Leda Sar, Mark Hasegawa-Johnson and Chang D. Yoo “*Counterfactually Fair Automatic Speech Recognition*” published in 2021