Crime Prediction

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Introduction

In Chicago's metropolitan scene, the ongoing battle against crime poses a daunting challenge, needing innovative solutions that harness the power of cutting-edge technologies. One such revolutionary technology is the use of Artificial Intelligence (AI) into crime detection tactics, namely through the perspective of crime hotspot mapping. This study aims to investigate the various elements of AI-powered crime detection, with a particular emphasis on its potential to revolutionize proactive enforcement activities within cities.

Chicago is dealing with complicated and dynamic crime trends that necessitate a smart approach to law enforcement. Traditional methods have proven insufficient in dealing with the complexities of criminal activity, necessitating the urgent need for sophisticated technologies that can deliver actionable insights. AI has emerged as a beacon of hope in recent years, demonstrating its power in processing massive information, finding patterns, and providing valuable predictive insights. As crime remains a major danger to urban safety, incorporating AI in crime detection becomes a strategic need.+

Commented [A1]: Situation(s)/Question(s) and Problem(s)

We will be modeling the tool on the city of Chicago using the crime dataset published by the city. We will be using the Community Area dataset as well as the current events datasets.

This study builds on a solid foundation of previous research, emphasizing the critical intersection of AI, crime mapping, and law enforcement strategies. Previous research has shed light on the effectiveness of predictive policing models, demonstrating the ability to anticipate criminal activity through data-driven insights. We hope to contribute to the evolving debate on the responsible and effective use of AI in crime prevention by connecting to the existing body of knowledge.

Commented [A2]: Connection to Literature

Our research proposes a novel framework that integrates AI-enhanced crime hotspot mapping into the operational fabric of Chicago's policing infrastructure as we delve into the complexities of crime detection. Our solution aims to provide law enforcement agencies with actionable insights by analyzing historical crime data, demographic trends, and environmental factors. This proactive approach not only promises more effective resource allocation, but it also aims to improve community safety, foster trust, and contribute to the ongoing discussion about the responsible implementation of AI in urban governance. In the pages that follow, we will examine the complexities of our proposed solution, including its technical foundations, ethical considerations, and potential impact on the safety and well-being of Chicago residents.

Commented [A3]: Solution(s)

Solution

The goal of this project is to make a basic crime prediction model which outputs the relevant crime areas categorized by community areas of Chicago. The input would be the date for the prediction

and the type of crime. The application would output k most risky areas in Chicago. This model leverages historical crime data and various socio-economic indicators to predict potential crime hotspots and types of crimes likely to occur.

Key components of the system:

1. Data Integration: The system integrates diverse data sources, including historical crime records, current events data, community area data, demographic data. This holistic approach ensures a comprehensive understanding of the factors influencing crime patterns.
2. Neural Network Architecture: At the heart of the solution lies a sophisticated neural network architecture, convolutional neural networks (CNNs). CNNs are utilized to process and analyze spatial data, effectively identifying geographic crime patterns.
3. Ethical Considerations and Bias Mitigation: Recognizing the potential ethical implications and biases inherent in predictive policing, the system incorporates mechanisms to mitigate bias and ensure fair and ethical use of predictive data.

Upon our initial research on various AI models, we found neural networks to be promising for their pattern recognition capabilities. The convolutional neural networks (CNNs) are adept at processing spatial information, making them ideal for analyzing geospatial data and identifying patterns in crime distribution across different neighborhoods. Training the neural network was done using historical crime data and current events data to form patterns between crime type, location and current events going on. This approach helps to find indirect connections between areas and crime types.

The model is learning continuously, updating itself from feedback and making sure that it provides accurate information overtime and incorporate feedback on updates. We plan to train the Neural network model every week by taking feedback from Police users about the accuracy of the model.

The goal is to make a web app which can take crime type and a specific date as input and highlight the riskiest crime areas on the map of Chicago. The web-app will make a request to the trained neural network receiving community areas. The web-app will query the community data set from the city of Chicago dataset and highlight the communities with their coordinates.

In the development of the web-app, we found the use of a human simulated tool for high stress decision making using ACT-R as we can train the model to react as a role model police officer which could help police make decision about efficient resource allocation.

Incorporating an ACT-R (Adaptive Control of Thought-Rational) model into this project is essential for simulating high-stress situations in policing, primarily for effective resource allocation. ACT-R, a cognitive architecture that mimics human thought processes and decision-making under various conditions, offers a sophisticated framework to understand how police officers react and make decisions under stress. By simulating these high-pressure scenarios, the model can provide valuable insights into

the cognitive limitations and biases that might influence officers' decisions during critical moments. This understanding is crucial for developing strategies that optimize resource allocation, ensuring that personnel and assets are deployed where they are most needed, especially in rapidly evolving and tense situations.

Relevance to the Introduction Module:

Understanding the Foundations: AI Policing Through Simon's Lens

Simon's investigation of artificial systems, which are purposefully constructed by humans to achieve specific purposes, is closely related to the main goal of our AI policing model. According to Simon, artificial systems, including economic, organizational, and cognitive systems, present a rich subject for scientific investigation. This is consistent with our approach to investigating AI as a viable issue in the context of crime detection.

The predictive neural network project AI models for crime prediction are relevant to Simon's exploration of the artificial and natural in "Sciences of the Artificial." Simon dives into the complex relationship that exists between artificial structures and their natural equivalents, emphasizing the adaptability and goal-oriented character of artificial systems, which are like modern AI models. By predicting crime, these models demonstrate a fundamental use of artificial intelligence, in which complex data is processed to achieve a specified, socially beneficial aim. This is consistent with Simon's viewpoint on the adaptability and purpose-driven design of artificial systems in a variety of situations.

Furthermore, our AI crime prediction research connects strongly with the issues in Simon's "Sciences of the Artificial." Simon's research highlights the importance of artificial systems in reproducing and enhancing human problem-solving abilities. Our AI models accomplish this by identifying crime patterns as well as suggesting appropriate remedies, demonstrating the artificial ability to augment natural processes. This combination of artificial intelligence and human decision-making in complicated situations, such as urban crime prevention, parallels Simon's conception of artificial intelligence as an extension of human cognitive processes.

Relevance to the Cognitive Systems Module:

The research paper on AI-powered crime prediction in Chicago aligns seamlessly with the principles and frameworks introduced in the Cognitive Systems Module, offering a compelling illustration of the intersection between artificial intelligence and cognitive science. The correlations become particularly evident when considering the "Standard Model of the Mind" proposed by Laird, Lebiere, and Rosenbloom (2017).

The model's emphasis on a structured approach to AI, featuring discrete modules and parallel processing, resonates with the inherent cognitive structures found in the human brain. By adopting this model, the crime prediction framework gains a systematic and organized structure that mirrors the way

human cognition operates. This structured approach enhances the accuracy of AI algorithms, enabling them to replicate human cognitive processes more effectively and thereby improving the overall precision of crime pattern forecasts. The parallel processing capabilities advocated by the model further contribute to the efficiency and speed of crime prediction, aligning with the cognitive systems' ability to handle multiple tasks concurrently.

The convergence of AI algorithms with the "Standard Model of the Mind" not only enhances predictive capabilities but also opens up avenues for more nuanced and context-aware applications in crime prediction. The modular design allows for the integration of various cognitive functions, resembling the complexity of human thought processes. This alignment supports law enforcement efforts by providing a sophisticated and human-like intelligence in the crime prediction domain.

Moreover, the research report underscores the importance of flexibility and learning in AI systems, mirroring key principles of cognitive systems. Just as cognitive systems adapt to changing contexts and learn from new information, AI models in crime prediction must continually evolve to produce accurate forecasts. This adaptability reflects the cognitive flexibility inherent in human decision-making processes, showcasing the potential for AI to emulate and enhance these aspects in practical applications.

The incorporation of AI in crime prediction, as highlighted in the research report, not only addresses a pressing social concern but also serves as a tangible manifestation of cognitive system principles in action. The synergy between AI and cognitive science exemplifies how technology can simulate complex cognitive capabilities, providing real-world solutions to intricate challenges. This alignment reinforces the idea that cognitive systems can serve as a guiding framework for the development and improvement of AI applications, particularly in domains where human-like intelligence and adaptability are crucial for success.

Relevance to AI & HUMAN Module

Sylvia Wynter's writings serve not only as a theoretical framework for the development of an AI-based crime detection system for policing, but also as a critical lens through which we approach concerns related to prejudice and representation. Wynter's investigation of the overrepresentation of the Western middle-class conception of "Man" challenges us to confront the potential biases embedded in historical facts and cultural structures. The potential persistence of bias, particularly in highly populated places associated with specific racial or ethnic groups, is a fundamental difficulty we face when adopting AI in crime detection. The worry is that historical data, which reflects current societal prejudices, may mistakenly lead the model to disproportionately target specific communities. This challenge aligns with Wynter's call for reevaluating ethnocratic representations, urging us to critically examine how our AI

system may reinforce existing inequalities. Our research aims to go beyond technological advancements by recognizing this challenge and drawing on Wynter's insights. We aim to develop an AI policing model that not only improves crime detection but also actively addresses and mitigates biases, resulting in a more equitable and just use of law enforcement resources. In conclusion, Sylvia Wynter's articles not only add to our understanding of societal struggles, but also provide a conceptual framework for navigating challenges related to bias and overrepresentation in the context of AI-based crime detection for policing.

1. "The fact that the theological grounds of the legitimacy both of Spain's sovereignty over the New World and of its settlers' rights to the indigenous people's lands had come upon a central obstacle..."

These quotes can be cited to add historical context and to highlight the challenges faced during the Spanish colonization, emphasizing the obstacles encountered in establishing legitimacy and rights over indigenous lands. Additionally, the reference to John Mair's neo-Aristotelian formula connects to the intellectual foundations shaping the perspectives of that era.

Relevance to the AI in Context Module:

The article "Semantics derived automatically from language corpora contain human-like biases" by Caliskan et al. serves as a vital reference in our research on AI for crime detection, particularly under the 'Context Module'. This research gives critical insight into how biases hidden in data might be unintentionally conveyed to AI systems. Such knowledge is particularly important for AI applications in crime detection, where algorithms, such as those employed in predictive policing, are trained on historical data.

While this data is rich in patterns and trends, it may also contain hidden societal prejudices that, as proved by Caliskan et al., AI systems can absorb and perpetuate. This creates a serious ethical quandary in our use of AI for crime prediction and prevention. The risk of incorporating these biases into AI technologies is that they may produce distorted predictions, potentially leading in unfair profiling or excessive targeting of specific demographics.

In accordance with the Context Module, our research must consider not just the technical capabilities of AI in crime detection, but also the broader societal impact, ethical implications, and obligation to maintain fairness and impartiality in AI-driven law enforcement techniques.

Finally, incorporating findings from Caliskan et al.'s work into our research provides a full picture of the obstacles and issues involved in using AI for crime detection. It emphasizes the importance of an intelligent, ethical, and contextually aware approach to bias mitigation, ensuring that AI acts as a tool for equitable and successful law enforcement.

Man Genre during AI development and ethical considerations

We are devoted to pushing beyond Sylvia Wynter's definitions of 'Man1' and 'Man2' in our AI project. These notions, which have their roots in historical and cultural contexts, provide a skewed picture of humanity. Our goal is to create artificial intelligence systems that accept a larger, more inclusive concept of human identity. We value the great diversity of human experiences and opinions that exists across cultures and communities. By embracing these varied perspectives, our artificial intelligence system will not only avoid replicating past prejudices but will also contribute to a more nuanced and comprehensive understanding of humanity in the digital age. This strategy will ensure that our artificial intelligence systems are egalitarian, fair, and representative of the worldwide human experience.

Ethical Consideration and Man consideration

1) Decolonizing Data: Addressing Bias in Crime Datasets for Equitable AI Policing

The process of creating an AI-driven hotspot mapping model for Chicago's crime detection involves traversing the complex landscape of historical biases that are ingrained in crime databases. Sylvia Wynter's sharp critique in "Unsettling Coloniality" serves as an important reference point, illuminating the societal hierarchies that have been sustained by historical categories. A critical analysis of how these colonial-era classifications have shaped our perception of communities and exacerbated structural inequalities is prompted by Wynter's analysis. Taking these realizations into consideration, our research endeavor attempts diligently to confront and correct biases in the historical crime datasets that could unintentionally exacerbate already-existing disparities.

Citing Wynter's work as a source, we acknowledge the urgent need to reevaluate and adjust our model to avoid unintentionally making it more biased toward any ethnic or socioeconomic group. We seek to demolish prejudices that may disproportionately impact communities, especially those that are members of marginalized groups, by closely examining historical evidence using a decolonial perspective. To guarantee a more egalitarian approach, the objective is to remove ourselves from the constraints of past prejudices that could affect the model's projections.

Our dedication to refraining from the continuation of discriminatory practices essentially coincides with Wynter's demand to upend long-standing colonial frameworks and question the normative presumptions that support them. We aim to contribute to a more equitable, moral, and objective framework in crime detection by integrating these factors into the very fabric of our AI model development, recognizing the agency of underprivileged communities in the urban scene.

2) **Privacy of data and security for user data**

Protecting the security and privacy of sensitive data is a top ethical priority in the creation of an AI-based crime detection and hotspot mapping system for the city of Chicago. This goes beyond only eliminating prejudices; it also touches on law enforcement agencies managing their data responsibly. Based on the larger discussion about data security and privacy, it is critical to put strong safeguards in place to stop unwanted access, distribution, or disclosure of the data that has been gathered.

Experts in privacy and security have emphasized the importance of using encryption technology, securing data storage procedures, and enforcing strict access controls as fundamental components of protecting data integrity. One such example is Solove's work on privacy law and regulation. This is essential for guarding against possible disclosures or abuses that can jeopardize the privacy of people and communities that are being watched.

A thorough approach also includes developing explicit data-sharing procedures, emphasizing the need of limiting access to authorized staff inside the police department. This aligns with broader issues about responsible AI governance, ensuring that data is used responsibly, and that individuals' rights are safeguarded. Commitment to privacy is not just a legal need, but also an ethical imperative in the development and use of AI technologies in law enforcement.

In essence, this ethical consideration aligns with the principles of responsible and accountable AI practices, contributing to a framework that prioritizes data security and confidentiality, instills public trust, and fosters a transparent relationship between law enforcement and the community.

Conclusion

In our exploration of AI's role in crime prediction, we've harnessed Chicago's data to illuminate hotspots, honing law enforcement's proactive edge. While promising, our model's efficacy hinges on ethical integrity, necessitating bias mitigation and privacy preservation. This research initiates an important dialogue, encouraging responsible AI deployment in policing. Future efforts must refine these models, embracing transparency and community engagement, to ensure justice and efficiency coalesce, enhancing urban safety in the technological era. Our work stands not as a conclusion but a beacon for continuous, collaborative advancement in AI's societal applications.

During our research, one important question we came across was “Does it help to decolonize crime data? Would it affect the accuracy of the model?” The question requires higher attention and needs to partake factors about till what extent does the demographic data affect the model accuracy. The real

question is how we even measure the accuracy of the model without deploying the tool and testing the accuracy and comparing the crime rates over a large period. During the time of the development of the model, we thought of the output of the model to be something arbitrary and can only be tested with actual deployment. We tried to compare the output of the model with the frequency of crimes in that area and understand the reason for the output of the model.

Moving forward with AI-powered crime prediction, it's crucial to concentrate on refining the neural network model through iterative updates and integrating feedback from law enforcement. Addressing ethical considerations is essential, with a focus on bias mitigation to prevent reinforcement of societal inequities and the implementation of robust privacy measures. Engaging with the community to foster transparency, developing policy frameworks, and collaborating across disciplines can broaden the impact and understanding of AI applications in predictive policing. Additionally, documenting and disseminating findings, and initiating pilot programs in varied urban contexts will be significant next steps to ensure the project's growth and societal alignment.

In everything, having data transparency with the public and having data hierarchy would be a necessity for the future development and ethical continuation of the project.

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