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# Fundamentals of Artificial Intelligence

## Module 6 Assignment

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# Frontiers and Challenges

## AI Improved Lives:

State 2-3 distinct ways in which AI technology has already and unquestionably improved people's lives. To set a standard for what 'improvement' means, here are some counterexamples – Facebook / Instagram "likes", and Tik-Tok video feeds.

Discuss briefly the nature of innovation of the examples you stated above that have made them successful and accessible.

**1. AI in Healthcare Decision-Making and Diagnosis:**

Artificial Intelligence (AI) has revolutionized healthcare by significantly enhancing clinical decision-making processes. As highlighted by Jiang et al. (2017) in their research, AI's capacity to analyze vast volumes of healthcare data, coupled with its ability to learn and self-correct, allows it to assist clinicians by offering up-to-date medical information crucial for patient care. In particular, the field of radiology has benefited immensely from AI. Radiologists are urged to incorporate AI technologies to better analyze diagnostic images. By unlocking clinically pertinent insights from massive data sets, AI not only supports physicians in delivering more accurate diagnostics but also reduces the potential for human error, improving the overall quality of patient care (Jiang et al., 2017).

**2. AI in Autonomous Vehicle (AV) Safety:**

The advent of Autonomous Vehicles (AV) brings forth both promises and challenges. As underscored by Nascimento et al. (2020), the role of Artificial Intelligence (AI) is paramount in

driving the development of AVs. These vehicles lean heavily on AI to replicate human-like decision-making when interpreting the environment and determining driving actions. There's a broad consensus on the potential of AI to enhance the safety of AVs. One predominant belief is that automating driving tasks via AI can drastically reduce vehicular accidents. However, a counterargument is that AI might introduce new risks. Nonetheless, it's evident that AI's integration with AVs has the potential to significantly bolster road safety, primarily by mitigating human error, which is a leading cause of accidents (Nascimento et al., 2020).

## 2. AI Introduced Harms:

State 2-3 distinct ways in which AI technology has introduced harm, or the possibility of, alongside their purported benefits.

Discuss briefly the nature of innovation and/or systemic "was (either in the market or policy or otherwise) that may have led to the harms.

**1. Deepfakes Affect Infomation Safety:**

AI-driven technology, especially deepfakes, poses significant risks to individual and societal integrity. Deepfakes are digitally altered videos or images that can convincingly depict people saying or doing things they never did. Often disseminated with malicious intent, these deceptive representations can spread misinformation, foster confusion around critical issues, and undermine trust in visual media. Their potential applications range from causing personal harm, such as through the creation of revenge porn, to threatening global political stability by manipulating perceived events or statements. As the technology evolves, detecting these

deepfakes becomes increasingly challenging, making it imperative for users to approach media content with heightened skepticism (Britt, K.2023).

**2. AI in Autonomous Vehicle (AV) Safety:**

Machine learning bias, or AI bias, is a critical challenge in the realm of artificial intelligence. This bias arises when algorithms, designed based on incomplete, erroneous, or prejudiced training data, produce systemically skewed results. Such biases, although often unintentional, have profound implications. They can lead to discriminatory practices, reinforce harmful stereotypes, and adversely affect decision-making processes in various sectors, including criminal justice, hiring, and healthcare. Ensuring AI fairness requires awareness, rigorous testing, and continuous validation of machine learning models against biases to guarantee equitable and just outcomes for all individuals (Gillis, A. S., & Pratt, M. K.,2023).

## Public Transport Optimization Using AI:

One of the key ways in which information (or AI) technology differs from other past technologies is its capacity to scale. Within very short periods of time, a technology may be globally disseminated. This can happen so quickly that the public and the makers could be caught unaware of the risks posed by the technology. So, in some ways, the scalability is both a feature and a bug.

But what if we did not aim to "solve" any given problem on a global scale? What if we assume from the get-go that the "solutions" we think of will be way off in the beginning and that we have to tweak them to get better with time iteratively? (think back about how a neural network its a function!) What if we only applied those solutions locally at first?

Think about one problem that is local in scope, which could harness the power of data and AI. Describe the problem, bribery, and describe how data/AI could be used to solve/mitigate the problem.

Describe briefly, how the application could be designed to improve over time.

Describe briefly, some of the practical challenges in terms of implementing such a solution.

Bonus. Describe briefly, how your envisioned system could be owned, operated, and financed.

**Problem Description**: The challenge is ensuring efficient passenger flow and serviceability in public transportation. Ideally, the aim is to reduce travel times, provide better access to areas currently underserved, and thus encourage private car owners to opt for public transport. This not only eases traffic congestion but also aids in reducing air pollution from vehicle emissions.

**How Data/AI Can Help**:

1. **Optimization of Bus Stops**: Using advanced techniques like GIS, Particle Swarm Optimization (PSO), and Genetic Algorithm (GA), it's possible to model and determine the optimal locations for bus stops. For instance, in Amman city, Jordan, such optimization led to a significant reduction in travel time on certain routes. Specifically, travel time on Zahran Street was reduced by up to 47.96% using GA (Shatnawi et al., 2020).
2. **Addressing Oversaturation and Undersaturation**: Streets with an excess of bus stops located at irregular distances can lead to longer travel times. Conversely, streets with an insufficient number of bus stops might result in longer walking distances for passengers but reduced travel time. AI can help strike the right balance. As evidenced by the study in

Amman, while the travel time increased on Al-Quds Street due to more stops, the walking distance to the bus stop dramatically decreased from over 2000 m to approximately 400 m (Shatnawi et al., 2020).

**Iterative Improvement**: The developed models, especially the PSO algorithm and GA, can be re-applied and refined based on the changing urban landscape and public transport demand. As more data is gathered, the models can be continually trained to adapt to the evolving needs of the city.

**Practical Implementation Challenges**:

1. **Data Accuracy and Collection**: Ensuring accurate data on passenger flow, bus timings, and urban developments is crucial.
2. **Infrastructure Limitations**: Even if AI determines an optimal location for a bus stop, practical constraints like road width, safety concerns, and nearby establishments might pose challenges.
3. **Public Acceptance and Behavior**: Changes in bus stop locations or schedules might be met with resistance from the public initially.

**System Ownership, Operation, and Financing**: The system could be owned and operated by the city's public transport authority in collaboration with urban planning departments. Financing could be sourced from city budgets, with potential partnerships with tech companies interested in smart city initiatives. Additional revenue streams can be explored, such as advertising at bus stops or partnerships with businesses located near optimized stops.

# References

A. M. Nascimento *et al*., "A Systematic Literature Review About the Impact of Artificial Intelligence on Autonomous Vehicle Safety," in *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 12, pp. 4928-4946, Dec. 2020, doi: 10.1109/TITS.2019.2949915.

Britt, K. (2023, March 31). How are deepfakes dangerous?. University of Nevada, Reno. https://www.unr.edu/nevada-today/news/2023/atp-deepfakes

OpenAI. (2023). ChatGPT (September 25 Version) [Large language model]. https://chat.openai.com

Gillis, A. S., & Pratt, M. K. (2023, June 1). *What is machine learning bias?: Definition from Whatis*. Enterprise AI. https://www.techtarget.com/searchenterpriseai/definition/machine-learning-bias-algorithm-bias-or-AI-bias

Jiang F, Jiang Y, Zhi H, *et al* Artificial intelligence in healthcare: past, present and future *Stroke and Vascular Neurology* 2017;**2:**doi: 10.1136/svn-2017-000101

Shatnawi, N., Al-Omari, A. A., & Al-Qudah, H. (2020). Optimization of bus stops locations using GIS techniques and Artificial Intelligence. Procedia Manufacturing, 44, 52–59. https://doi.org/10.1016/j.promfg.2020.02.204

Shakshuki, E., & Reid, M. (2015). Multi-agent system applications in healthcare: Current Technology and Future roadmap. *Procedia Computer Science*, *52*, 252–261. https://doi.org/10.1016/j.procs.2015.05.071