

The emerging trend I chose to analyze was centered around developments in artificial intelligence (AI) navigation. Currently, navigation is conducted by inferring locations on a map by utilizing Global Positioning System (GPS) coordinates. However, this trend disregards both facets to teach the AI how to develop an internal representation of space based on recognizable landmarks and visual cues (Mirowski et al., 2019). The agent was not given its start or end coordinates and utilized reinforcement learning techniques to support continuous self-localization based on a formalized Markov Decision Process (MDP). Random goals, in the form of destinations in a city, were given to the agent, with rewards provided if the agent took an optimal path. Furthermore, the agent utilized a multi-pathway neural network to support separate learning mechanisms for general and locale-specific navigation (Mirowski et al., 2019). This trend is related to the maze pathfinder agent in Project Two, which leverages reinforcement learning to identify efficient routes through an unfamiliar environment. However, this trend complicates the problem of ensuring the agent can only operate on recognizable landmarks and visual cues.

This emerging trend poses several potential benefits. Most notably, the agent learned how to identify its own location and efficiently reach a pre-determined destination solely from spatial features, which could be highly beneficial for travel, deliveries, or humanitarian aid in underdeveloped areas or where connectivity may be unstable. Furthermore, the agent was able to easily identify optimal routes in new environments by transferring general navigation knowledge gained in previous environments (Mirowski et al., 2019). This trend is designed to provide an alternative form of navigation for AI agents, which may be utilized for future transportation methods or when signal connectivity is intermittent. A significant limitation to this trend is the viability of already-used mechanisms such as GPS combined with mapping tools, which are

becoming increasingly prevalent as technology expands. Furthermore, the agent was only designed to come within 100 meters of the target location to obtain a reward, which may be lackluster when precision is necessary. The main ethical implication is the lack of a model for traffic control while learning. Therefore, it is unclear how the AI would act when faced with dynamic traffic environments, such as halted traffic. Subsequently, this technology would require supplemental tools to incorporate the necessary measures to comply with traffic regulations.

## References

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