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Smart Path Finder via Neural A-Star

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Abstract: *In today's fast-paced and ever-evolving technological landscape, intelligent navigation systems are increasingly vital across numerous domains—from robotics and autonomous vehicles to gaming and logistics. This paper presents the design and implementation of a Smart Path-Finding System leveraging a neural variant of the classic A* (A-Star) algorithm, aimed at enhancing real-time decision-making in dynamic environments.*

The proposed system integrates the classical heuristic efficiency of A with the predictive power of neural networks to address the limitations of traditional path-finding, particularly in environments that are large-scale, partially observable, or constantly changing. In this framework, a deep learning model is trained to approximate heuristic values by learning from previous navigation patterns across various map topologies. This enables the system to dynamically adjust path costs and anticipate better routes, rather than relying solely on static heuristic functions like Euclidean or Manhattan distances.*

The core architecture of the system includes a grid-based map environment, where obstacles and path costs can vary in real time. Data preprocessing involves encoding the environment into state representations, where each grid cell is translated into feature vectors representing obstacles, dynamic costs, and proximity to the goal.

To ensure robust performance, the system undergoes extensive simulation testing on both synthetic and real-world-like environments. Performance metrics include path optimality (compared to traditional A), time-to-solution, adaptability to environment changes, and computational efficiency.*

Keywords: Sentiment Analysis, speech-to-text technology, Machine Learning Models, Helpdesk Interactions and Business Impact

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