Abstract of my research project with Stanford University and NYU Stern

Behavior Cloning (BC) of Human Policy via Logged Data

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Abstract:
This research focuses on leveraging machine learning (ML) to learn human decision policies through behaviour cloning in the context of the classic Snake game. Utilizing a manually collected dataset representing game states and corresponding human actions, we trained a Convolutional Neural Network (CNN) to predict the next user action with a remarkable accuracy of 93% on the testing dataset.

Methodology:
The research team underwent training in essential skills and collected data by playing the Snake game extensively. Data engineering involved connecting to AWS S3, extracting and consolidating JSON files, and employing heuristics to enhance dataset volume. For modelling, a CNN was implemented, comprising two convolutional layers, two max-pooling layers, two fully connected layers, and one softmax layer. The model evaluation involved deploying the trained CNN to play the game on a testing dataset.

Results - Comparative Analysis:
The project explored three heuristics—Manhattan Distance, Euclidean Distance, and Hamiltonian Cycle—to guide the computer's learning in imitating human gameplay. Each heuristic provided unique insights into decision-making strategies. The combination of these approaches aimed to create a holistic understanding of human behaviour patterns, extending the potential of this learning to real-world problem-solving scenarios beyond gaming.

Limitations, Discussion, Future Work:
Limitations include the reliance on limited data sources and time constraints. The use of existing datasets for the Snake game introduced some limitations. The CNN achieved a commendable 93% accuracy, but future work should incorporate diverse CNN architectures for comparative analysis. Mimicking player strategies based on predicted actions and exploring alternative CNNs like EfficientNet, VGG, and AlexNet are avenues for future improvement.

Conclusion:
The CNN-based model successfully predicted human actions in the Snake game, showcasing its effectiveness in mimicking experienced players. With a 93% accuracy, the project not only underscores the advancements in machine learning but also demonstrates the potential for intelligent gaming systems. This research serves as a stepping stone towards shaping the future of gaming by enhancing user experiences through the application of cutting-edge machine learning techniques.