Utilizing Eye Gaze Data: Sudoku Game Decision Modelling of Experts/Novices

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Motivation
- Tasks with sequential decisions ($$$)
  - Traders -> screens
  - Chess players -> game boards
- Advent of eye-gaze technology
  - Precise eye-tracking
  - Reasonable costs
- Generalize users’ on-screen behavior
- Hope to extend findings to the financial applications at J.P. Morgan

Problem Statement
- Expert vs. Novice of Sudoku Games
  - Analysis - Data visualization & Gaze pattern extraction
  - Prediction - Feature Engineering & Deploy ML to predict expert/novice

Game Design
- 4 by 4 sudoku puzzle
  - Smaller data volume
  - Reduce eye-gaze data errors
- Colored zones
  - Game area & selection area
  - Easier for players to focus
- 3 levels of difficulties
  - 2/8/12 blanks

Data Collection & Exploration
- Conducted two rounds of experiments to collect data
  - Invited a single student to solve the game and observe the initial pattern
  - Extended the experiments to 20 students to verify the ideas
- Designed a questionnaire to distinguish experts and novice

Feature Selection & Feature importance
- Our team built a pipeline to create four intuitive and meaningful features to feed into our interpretable models including
  - the correctness of input
  - difficulty levels
  - time-spent in the decision making process
  - the transition matrix

Figure 4. Processed gaze location
Figure 5. Transition matrix
Figure 6. Difficulty level interpretation

Models & Prediction Results
- Logistic regression 70.34%
- Random forest 73.25%
- Light GBM 80.23%

Conclusions and Acknowledgements
Our team has predicted whether the player is an expert or novice with a relatively high accuracy using the Sudoku software designed by our own and aimed to generalize to other fields like financial industry. We would like to thank Dr. Cohen and his team for giving us the opportunity and careful guidance to work on this project.

References