Identifying Criminal Cases that Use Neuroscience

Neuroscience evidence has been increasingly used in criminal cases as mitigation for defendants. Dr. Nita Farahany manually located and labelled 2,700 such cases from 2005 to 2015. Our team used document vectorization and binary classification algorithms to find cases that presented neuroscience as evidence in criminal cases from 2016 to 2018.

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**Methodology**

**Data Collection**
Downloaded cases from online legal database WestLaw using a **keyword list** made by Dr. Farahany (e.g., brain, neuro!, EEG, fMRI)

**Feature Extraction**
- Import cases
- Remove stop words (e.g., “the”, “is”, “and”)
- Extract contextual paragraphs
- Export TFIDF matrix

**Model Training**
Multi-Layer Perceptron (MLP) and Random Forest (RF) Classifiers
- **Capture relevant cases**: cases that use neuroscience as mitigation
- **Eliminate irrelevant cases**: cases that mention keywords in a context other than mitigation
- Optimize precision for irrelevant cases + recall for relevant cases to confidently remove irrelevant cases

**Background**

![Number of cases trend (2005 - 2015)](image)

- The number of cases using neuroscience evidence increased significantly from 2005 to 2015; within these cases, the number of cases resulting in favorable outcomes for the defendants steadily rose
Results

- Capture relevant cases: cases that use neuroscience as mitigation
- Tested on 2,716 cases from 2016 and verified predicted labels for 809 of them
- Precision for irrelevant cases and recall for relevant cases remained relatively high, so we remain optimistic that both models can be used in the future

Future Work

- Capture relevant cases: cases that use neuroscience as mitigation
- Refine binary classification algorithms for cases from 2017 and 2018
- Automate the variable extraction process (e.g., year, court level, nature of evidence)

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