An Application of Natural Language Processing (NLP) to Free-form Police Crime Notes

Dr. Darren Cook

darren.cook@city.ac.uk

Structure

- About VISION
- Data integrity problems in domestic violence
- How NLP can improve quality of data
- Performance evaluation on a text classification task

About VISION

Violence, Health and Society (VISION) is a UKPRP backed consortium aiming to reduce societal harm caused by violence.

Collaboration of criminologists, economists, psychiatrists, computer scientists and domain experts from seven UK universities.

A core aim of VISION is to improve the measurement of data on violence to influence policy and decision-making.

Data Integrity Problems in Domestic Violence Reporting

Domestic violence is a growing problem throughout the UK.

The accuracy of police recorded crime (PRC) is vital to preventing further harm.

Integrity of police recorded crime is low due to:

- Inconsistent recording practices
- Underreporting (missing values in structured data)

UK Statistics Authority no longer consider PRC in official statistics

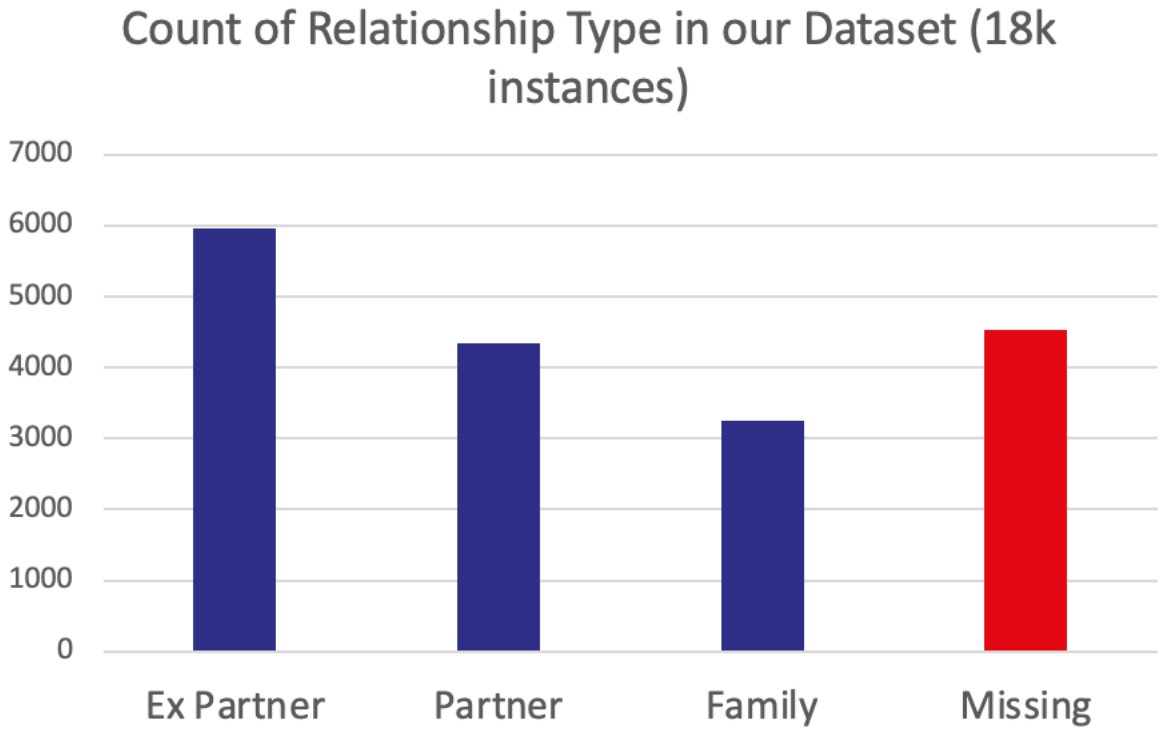
How can NLP Enhance Data Quality?

Our approach: IE and supervised ML to populate missing values.

Data: 18k police reported DV incidents over three years.

Outcome: Relationship between victim and offender.

Predictors: Free-text crime notes.



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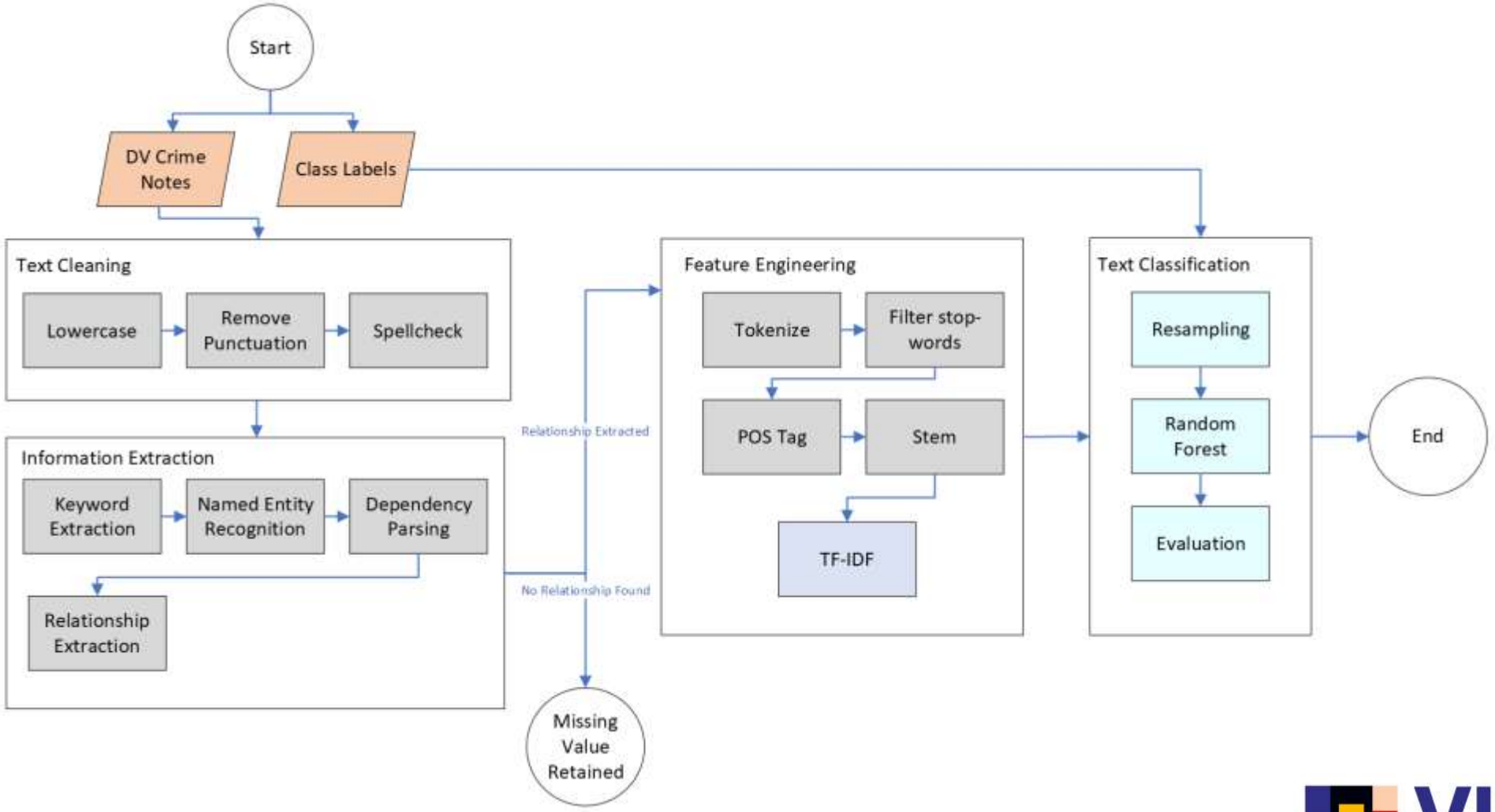
Example of a Police Crime Note

"*Mother* and adult *son* live together. *Mother* requested her *son* provide her with assistance in moving a bed. *Son* became aggressive and irrationally angry. *Son* placed hand around her neck and tightened grip after being told to leave. Arrested at scene."

Classification Pipeline



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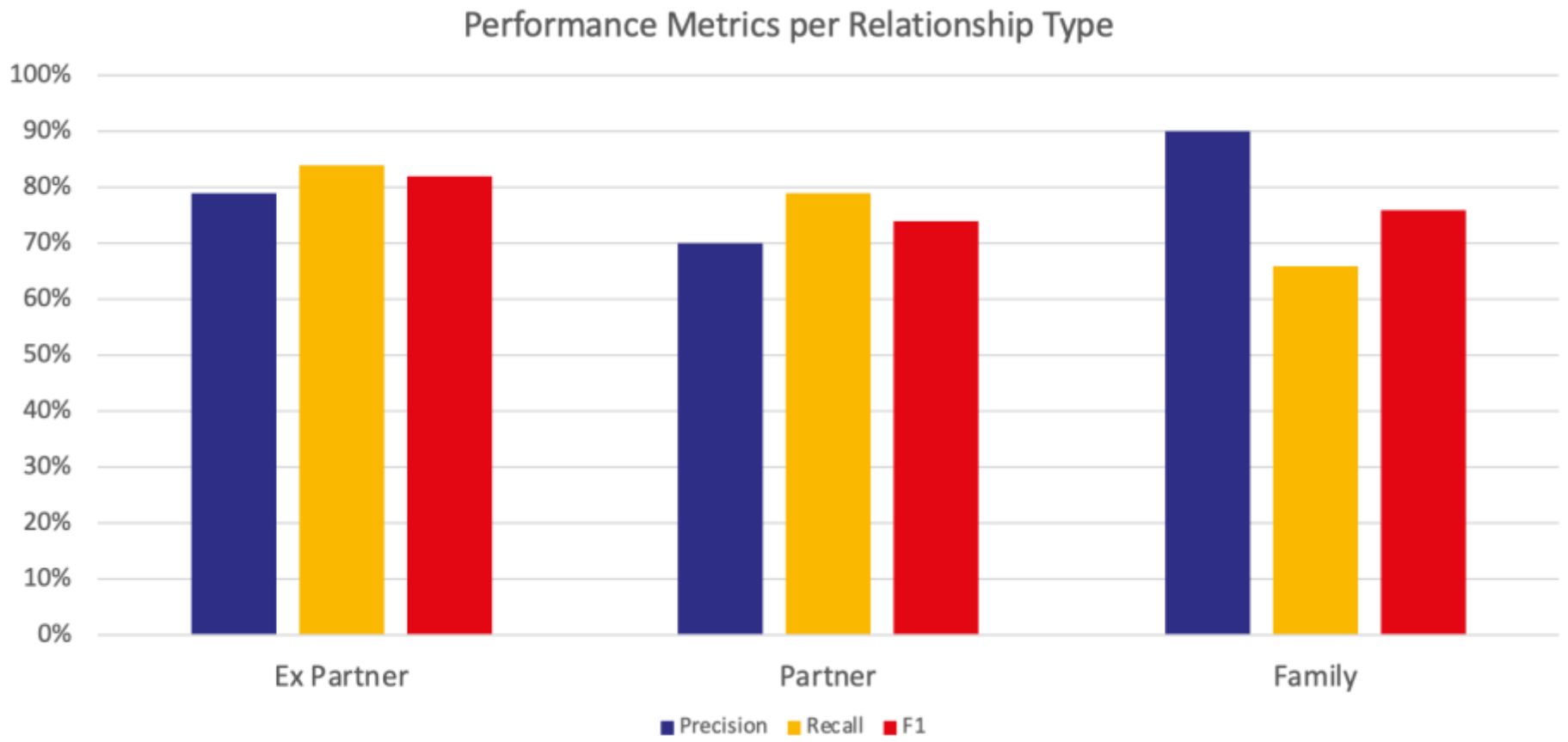
Random Forest Evaluation

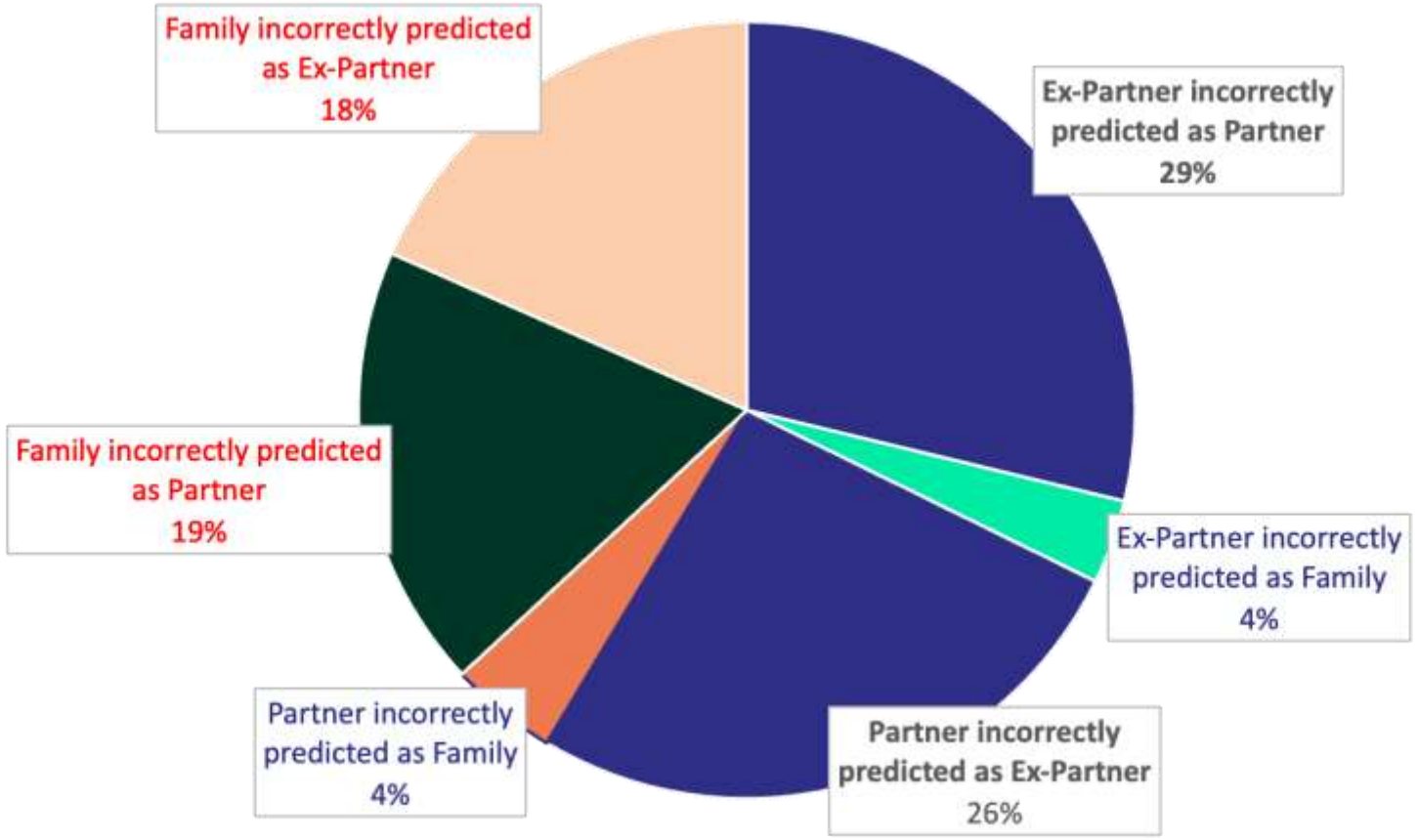


Understanding Individual Predictions

"Mother and adult son live together. Mother requested her son provide her with assistance in moving a bed. Son became aggressive and irrationally angry. Son placed hand around her neck and tightened grip after being told to leave. Arrested at scene."

Group	Model Confidence
Family	**63%**
Ex-Partner	10%
Partner	27%

Misclassifications



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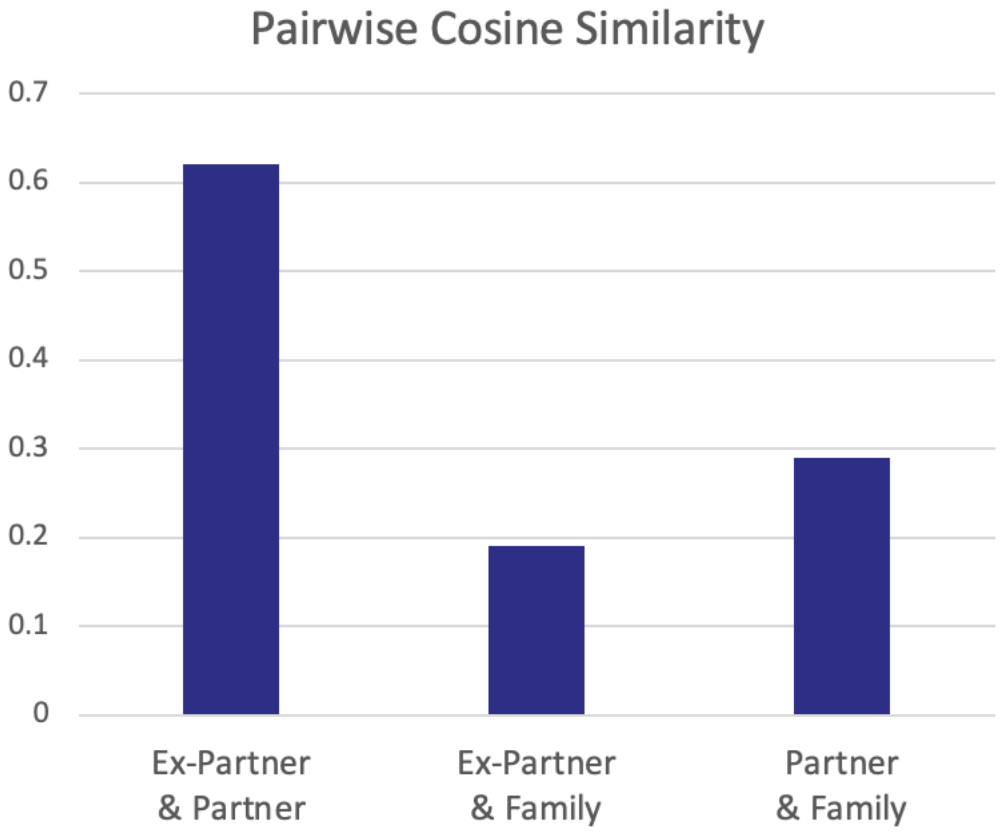
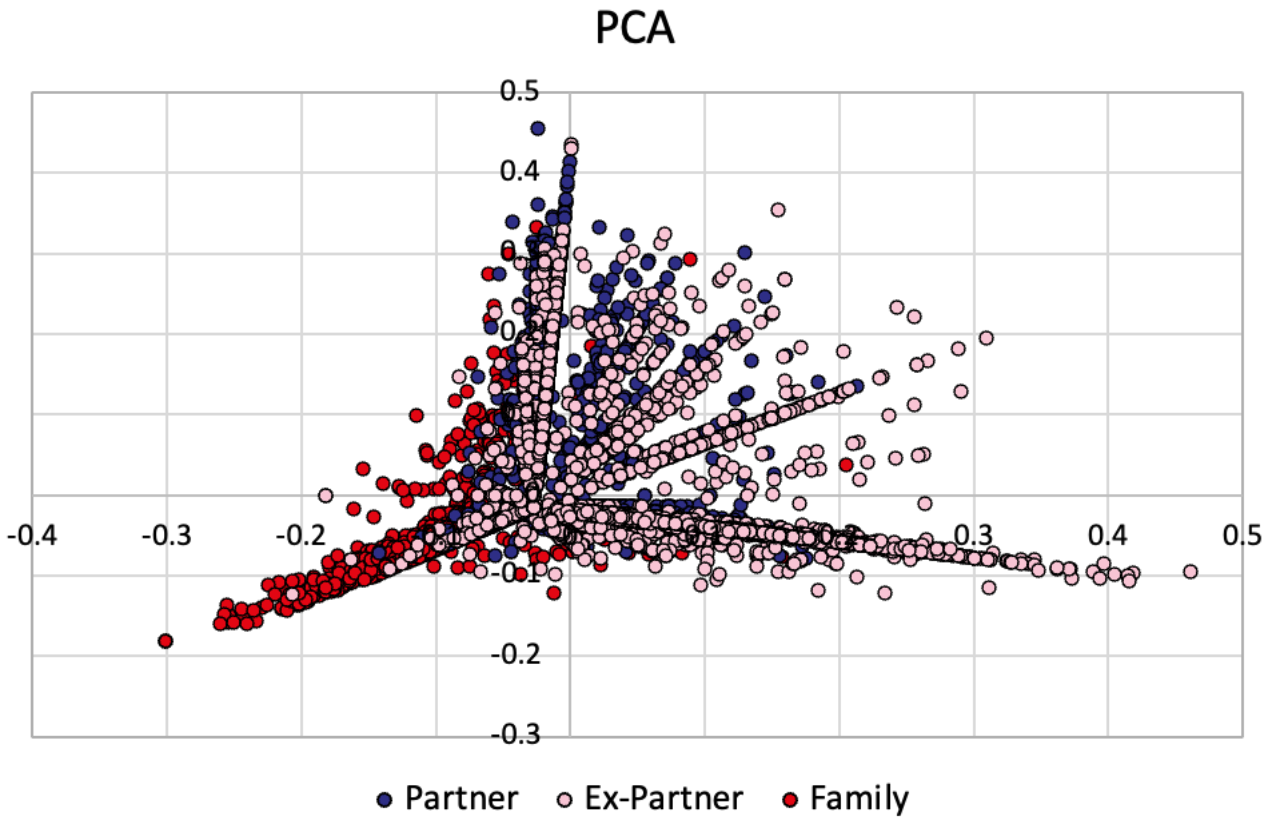
Class Similarity (using top-10 features)





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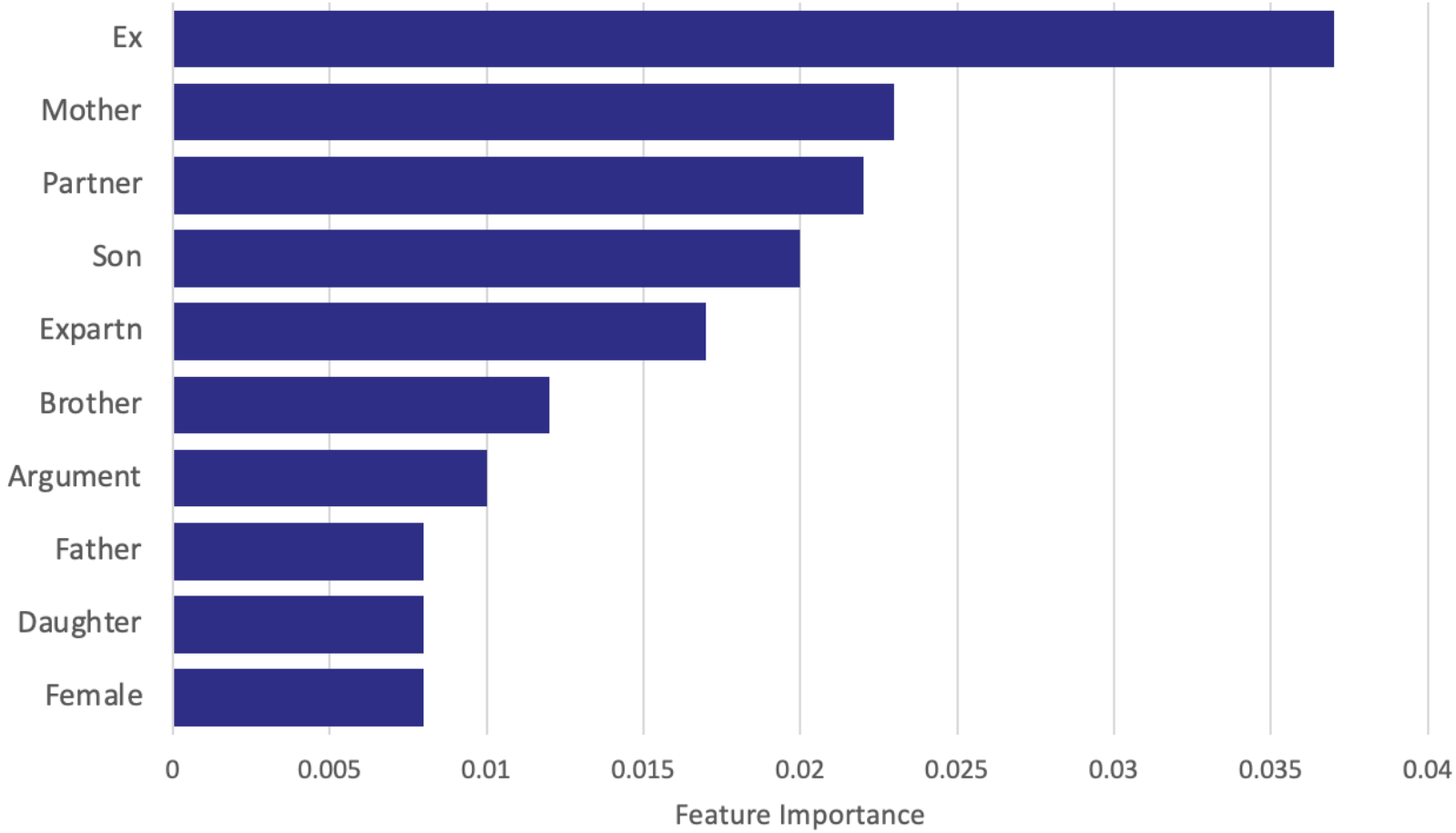
Top-10 Features



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Performance Bias Against Protected Characteristics (Preliminary)

By Victim Gender	FPR	TPR	Average Odds Difference (AOD)	Equal Opportunity Difference (EOD)
Female (majority)	11%	77%	-	-
Male	10%	80%	0.01	0.02
By Victim Ethnicity				
White (majority)	11%	77%	-	-
Black	17%	67%	0.05	0.11
Asian	14%	71%	0.03	0.06
Mixed	12%	76%	0.01	0.01

Summary of Findings

Performance: Four-out-of-five predictions were correct.

Underfitting: Model underfits to Family class – next steps to include synthetic oversampling to balance the data.

Misclassifications: Class overlap caused confusion – alt. methods such as word embeddings and/or Transformers *might* improve performance.

Prediction Bias: Suspected bias against minority groups.

Thank You!

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Contact

darren.cook@city.ac.uk
LinkedIn: darrencook1986

References

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[3] Karystianis G, Cabral RC, Adily A, Lukmanjaya W, Schofield P, Buchan I, Nenadic G, Butler T. Mental illness concordance between hospital clinical records and mentions in domestic violence police narratives: data linkage study. JMIR formative research. 2022 Oct 20;6(10):e39373.