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Using financial information to detect live streaming of child sexual abuse

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What is live streaming of child sexual abuse?

- Live streaming of child sexual abuse (CSA) features the procurement and viewing of sexual abuse of children across the internet in real time, in exchange for money
- This crime type often involves a third-party who facilitates the offence
- The nature of CSA live streaming results in barriers to monitoring by authorities, and prosecution, with little tangible evidence of the offence beyond a financial transaction
- Financial transactions made by individuals involved in CSA live streaming are difficult to identify, and as a result little is known about large scale trends, or offending methodologies

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What did we want to do?

- We sought to better understand offenders that live stream CSA through applying analytical methods, and if possible to predict which individuals would engage in high volume offending.
- Several datasets were linked to provide details of transactions made by offenders to known facilitators of live streaming, the demographics of these individuals, and their criminal history.
- A machine learning analyses were undertaken intending to understand and predict which individuals would engage in high volume live streaming.

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Background and sample

- In 2018 police in the Philippines provided the Australian Federal Police with a list of 118 individuals arrested for facilitating the sexual exploitation of children (facilitators).
- Details of these individuals were provided to the Australian Transaction Reports and Analysis Centre (AUSTRAC) who identified 299 Australia-based individuals who had made financial transactions with the facilitators.
- Data for these 299 individuals were provided to the Australian Criminal Intelligence Commission, to be matched with criminal history

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Characteristics of offenders

Characteristics of individuals that live stream Child Sexual Abuse	
Characteristic	Average (range)
Age at first live streaming transaction	52.18 (20-76)
Age at first criminal offence (non-live streaming)	40.14 (n=111) (18-76)
Mean number of criminal offences	3.24 (1-51)
Mean number of live streaming transactions	12.23(1-141)
Median days between live streaming transactions	26.5 (0-746)
Median value spent per live streaming transactions	65.41 AUD (11-1306)

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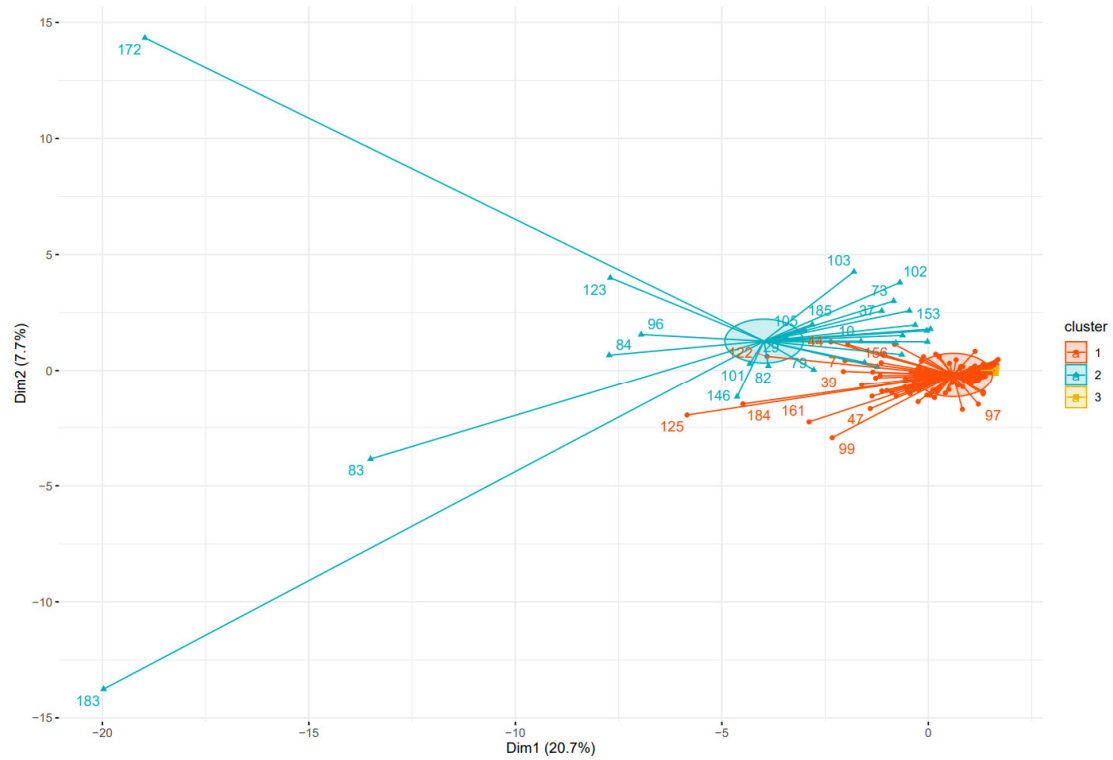
Analysis 1: Are all live streaming offenders the same?

- We first attempted to understand whether all CSA live streaming offenders were similar, or if it was a diverse group of offenders
- To do this we applied a machine learning technique known as k-means to identify whether there were sub-groups among CSA live streaming offenders that behaved differently to others.
- This analytic approach resulted in a high degree of accuracy, and identified 2 key sub-groups among CSA live streaming offenders.

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There were two distinct groups of live streaming offenders



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What were the differences between these groups?

Differences in characteristics between groups		
	Cluster 1 (n = 178) (Range)	Cluster 2 (n = 28) (Range)
Age at first live streaming transaction	51.8 (20-76)	53.9 (37-74)
Mean number of criminal offences	2 (1-25)	11.5 (1-51)
Mean number of live streaming transactions	12.5	8.1
Median days between live streaming transactions	28.7 (0-746)	13.8 (0-150)
Median value spent per live streaming transactions	70.2 AUD	61.6 AUD

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What were the differences between these groups?

Number of offences per offender		
Offence type	Cluster 1 (n = 178)	Cluster 2 (n = 28)
Sex offence against an adult	0	0.785
Sex offences against a child	0	0.321
Assault	0.112	1.464
Attempted murder	0	0.143
Breach bail or community order	0.101	1.107
Drug offences	0.197	0.821
Break and enter	0.051	0.821
Exceed speed limit	0.455	0.964
Theft	0.230	0.964
Resist arrest	0.050	0.537
Drink driving	0.197	0.250
Public order offence	0.197	1.285
Property damage	0.033	0.179
Dangerous or negligent driving	0.051	0.464
Weapons or explosives offences	0.034	0.179
Fraud	0.039	0.071
Aggravated robbery	0	0.071
Harassment or threats	0.006	0.143
Manslaughter	0	0.036
False imprisonment	0	0.036
Stalking	0	0.036

Analysis 2: Can we predict who will offend in high volume?

- This analysis attempted to predict which individuals would engage in high volume live streaming and which individuals would not.
- High volume live streaming was categorised as 20 or more transactions to known facilitators of live streaming of CSA.
- The analytical method used here is known as a random forest. A Receiver Operating Characteristic (ROC) curve was used to determine the predictive power of this model, with Partial Dependence Plots used to interrogate important variables.

This was a strong predictive model

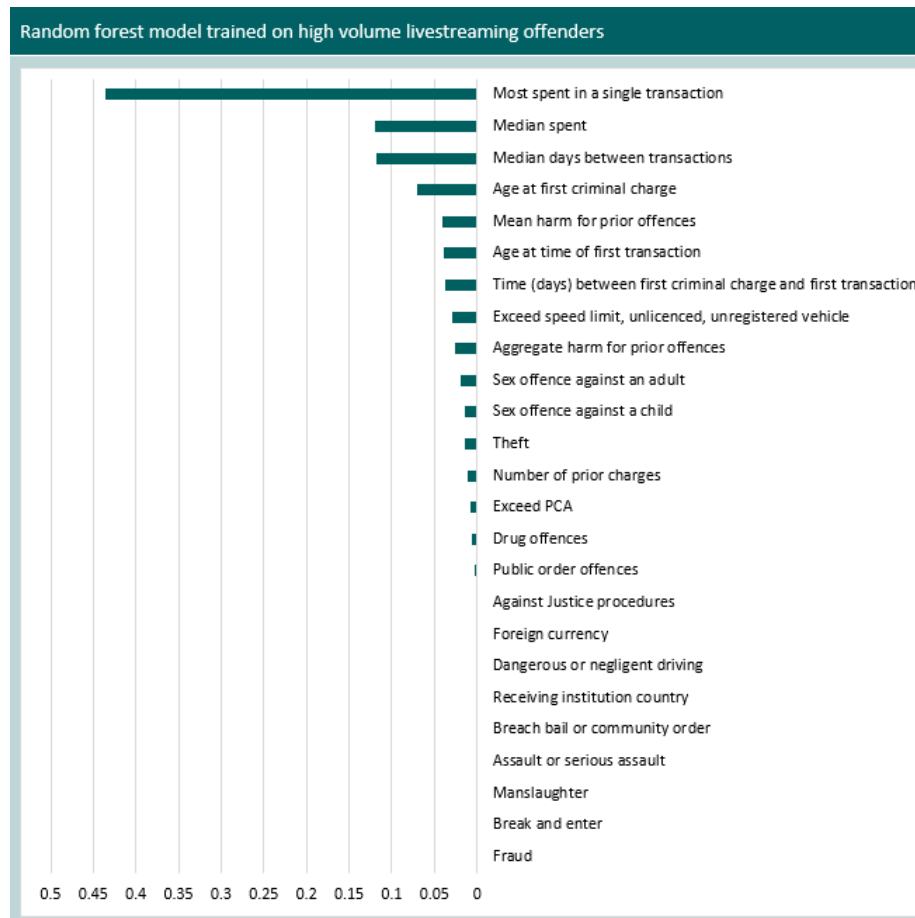
- The random forest model successfully predicted whether individuals would or would not engage in high volume live streaming with 85.2% accuracy (AUROC = 0.852).

Confusion matrix for predicting high volume live streaming offenders			
	True negative	True positive	Classification error
Predicted negative	59	2	4.8%
Predicted positive	2	6	25%
Classification error	4.8%	25%	69

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Transaction details were most important

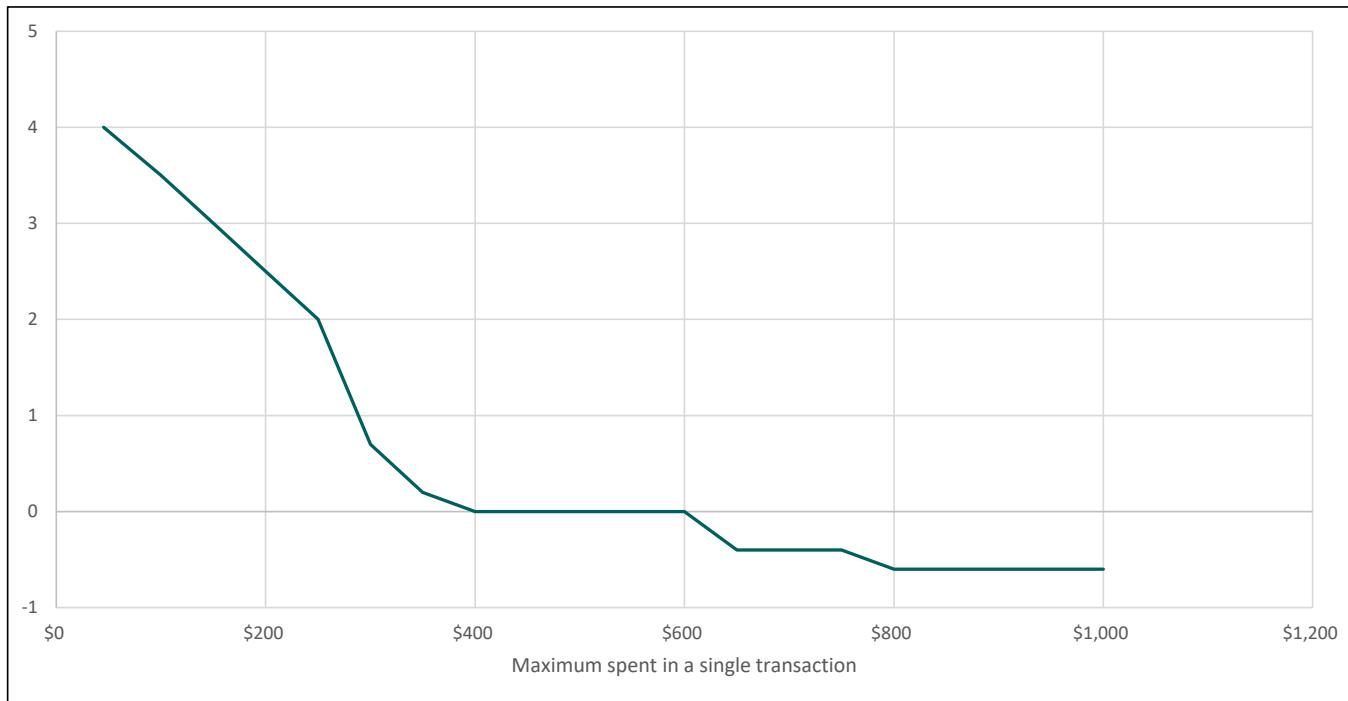
- The three most predictive features of this model were characteristics of financial transactions. However, types of prior offences weren't good predictors.



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Maximum spent of high volume offenders was low

- The most spent in single transaction suggested that high volume live streaming was most likely among individuals whose maximum spend was below \$300. Where the most spent in a single transaction was over \$400, likelihood of prolific live streaming was low.

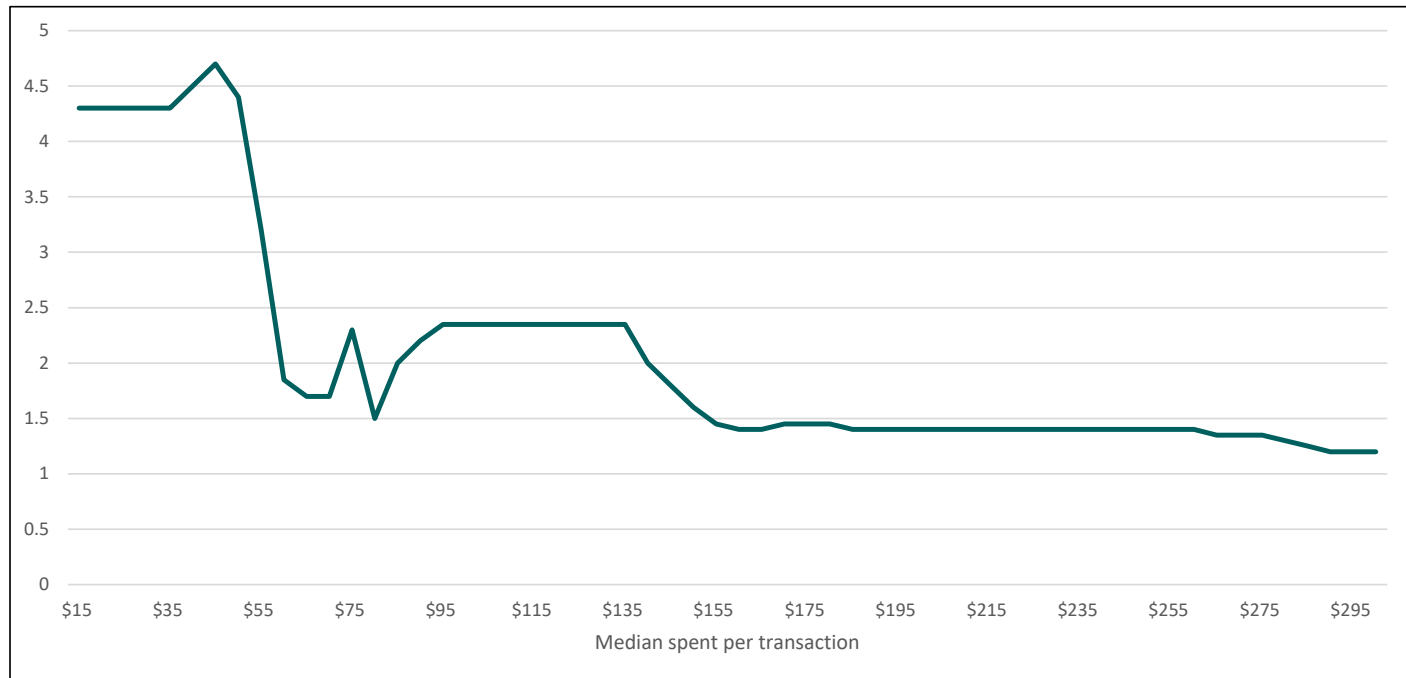


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Median spend of high volume offenders was low

- Similarly to the most spent variable, where the median spend was relatively low there was a higher likelihood of high volume livestreaming.

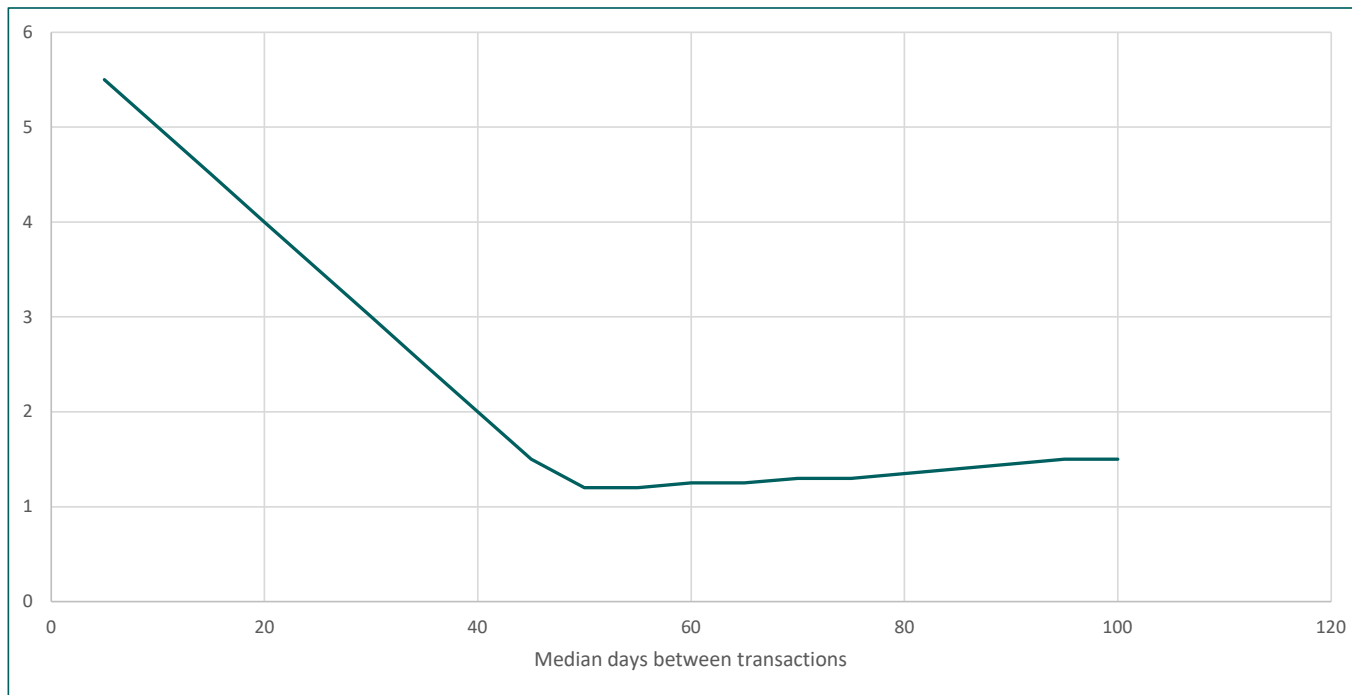


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Intervals between transactions were short

- High volume live streaming offenders were most associated with short time-periods between transactions. Where there were fewer than 30 days between transactions the likelihood of high volume live streaming was particularly high.



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Summary

- High volume live streaming offenders were associated with moderate spending behavior at frequent intervals, and were less likely to make single high value transactions. These individuals were also unlikely to have a history of violent or high harm offences.
- Financial transaction characteristics were most important in making these predictions.
- This analysis highlighted the importance of including a range of data from different sources, and the potential for machine learning in accurately identifying high volume live streaming offenders.

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