

# Detecting Trafficking Networks

AGG, JWB, MM

**Task 1**

**Task 2**

**Task 3**

**GUI**

# EDA

- Data is very imbalanced, with only ~2% positive labels
- Observable differences in age & tenure
- No differences between men and women
- Large occupation specific differences



## Dr. John Wade

- 36, male, lawyer (and doctor!)
- Customer for 5 years
- Suspicious e-transfer messages
- Wire transfers to Australia
- Large cash withdrawals



# Features

Sources: Fintrac & Financial Crime Academy

1. Customer features
2. Transactional features

Cash  
Features

- `c_large` ( $1.5 * \text{IQR\_occupation}$ )



C

c\_large

Node  
Features

- occ\_wealth (e.g. Art Dealer)
- occ\_animal (e.g. Vet)
- occ\_int (e.g. Importer/Exporter)
- label
- named\_trafficker

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

EMT  
Features

- e\_at\_risk (e.g. "bear skin", "elver")
- e\_role (e.g. "poacher")
- e\_trad\_med (e.g. "costus")

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

E

e\_at\_risk  
e\_role  
e\_trad\_med

Wire  
Features

- w\_to\_country (e.g. CN, AU)
- w\_from\_country
- w\_external\_to\_animal

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

E

e\_at\_risk  
e\_role  
e\_trad\_med

W

w\_to\_country  
w\_from\_country  
w\_external\_to\_animal

Transaction  
Features

- t\_to\_animal
- t\_from\_animal
- t\_to\_animal\_large
- t\_from\_animal\_large
- t\_to\_shipping

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
**named\_trafficker**

E

e\_at\_risk  
e\_role  
e\_trad\_med

W

w\_to\_country  
w\_from\_country  
w\_external\_to\_animal

T

t\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

E

e\_at\_risk  
e\_role  
e\_trad\_med

W

w\_to\_country  
w\_from\_country  
w\_external\_to\_animal

T

t\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

## Zero Shot Classification

bart-large-mnli

- ["illegal wildlife trafficking", "not illegal wildlife trafficking"]
- $\text{score} = P(\text{"illegal wildlife trafficking"})$
- How do we filter these spurious results?

	txn_id	txn_message	score
	4155 MHOE70796434	Charity donation	0.013745
	309545 QPHS11640556	Charity donation	0.013745
	249202 KJXO99518509	Flea market	0.016959
	484088 XJJU77211973	Grocery run	0.019447
	272700 WQKA11762800	Grocery run	0.019447
...	...	...	...
	201126 WYOV78305919	Movers charge	0.574710
	310778 EYPL29649215	Leopard print leggings	0.600782
	405966 PAIL92355460	Leopard spot dress refund	0.629985
	218103 CKUM58467575	Shark skin laptop sleeve	0.709061
	499692 SVVZ91014315	Elephant print leggings	0.903360

C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

E

e\_at\_risk  
e\_role  
e\_trad\_med

W

w\_to\_country  
w\_from\_country  
w\_external\_to\_animal

T

t\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

## Embedding Similarity

all-MiniLM-L6-v2

- Encode all messages
- Encode query
- `score = cosine_sim(query, message)`
- Allows for more semantic reasoning i.e.:

```
query = enc('wildlife') + enc('animal') - enc('pets') - enc('clothes')
```

- Cc\_large
- Nocc\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker
- Ee\_at\_risk  
e\_role  
e\_trad\_med
- Ww\_to\_country  
w\_from\_country  
w\_external\_to\_animal
- Tt\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

Embedding Similarity									
all-MiniLM-L6-v2									
	cust_id_sender	cust_id_receiver	name_sender	name_receiver	txn_message	emt_value	txn_id	regex_flag	sim
475823	CUST99713635	CUST27905790	DR.AURÉLIE BÉLANGER	JAMIE KANE	hockey game	25.0	YTCI86579764	0	0.100014
109660	CUST28513145	EXTERNAL860241	GARY MOSES	DANIEL EWING	repair car	398.0	PXBR88814074	0	0.100166
144040	EXTERNAL728152	CUST13679985	SEAN STOKES	SHASHKOVA NINA VLADIMIROVNA	repair car	296.5	DNFI54321351	0	0.100166
471335	CUST45513267	CUST91210851	DANIELLE RAMIREZ MD	CHELSEY EVANS	new plant	17.0	JMVV78593312	0	0.100207
299516	CUST12093402	EXTERNAL674636	ALEKSANDRA L'VOVNA BIRJUKOVA	CHRISTOPHER RICHARDSON	new plant	20.0	VLSG91123535	0	0.100207
...	...	...	...	...	...	...	...	...	...
418487	EXTERNAL454131	CUST31203996	JESSICA MORGAN	MICHELLE BURNS	vet charge, rex	99.0	ILSN36742463	0	0.243448
480263	CUST85769551	CUST80174234	DAVID WILKERSON	STEVEN CRUZ	moose meat	978.0	IBCA52577297	0	0.247712
244234	CUST16646570	CUST15473364	MELISSA MOORE	DR.RICHARD ALLEN	movi tick	5.0	NZXF72639436	0	0.249867
68168	CUST13316799	CUST70977942	JOANN BERRY	LUCAS-NICOLAS GIGUERE	for my beautiful bird	3245.0	JATA51813366	0	0.254255
326524	CUST95690421	EXTERNAL956185	DR.CHANTAL BERGERON- LACROIX	CHELSEY MILLS	adoption of a star named sea horse	44.0	QMVZ49585077	0	0.288899

query = enc('wildlife') + enc('animal') - enc('pets') - enc('clothes')



C

c\_large

N

occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_trafficker

E

e\_at\_risk  
e\_role  
e\_trad\_med

W

w\_to\_country  
w\_from\_country  
w\_external\_to\_animal

T

t\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

## Regex

- Positive flags: geese, gall, bones?, ivory
- Negative flags: dinner, sharkskin, drank ur bear, tiger king
- Tried fuzzy matching - a lot of small strings (fox->for, bear->beer)
- Less robust... but much better results

C c\_large

N occ\_wealth  
occ\_animal  
occ\_int  
label  
named\_traffickerE e\_at\_risk  
e\_role  
e\_trad\_medW w\_to\_country  
w\_from\_country  
w\_external\_to\_animalT t\_to\_animal  
t\_from\_animal  
t\_to\_animal\_large  
t\_from\_animal\_large  
t\_to\_shipping

## Regex

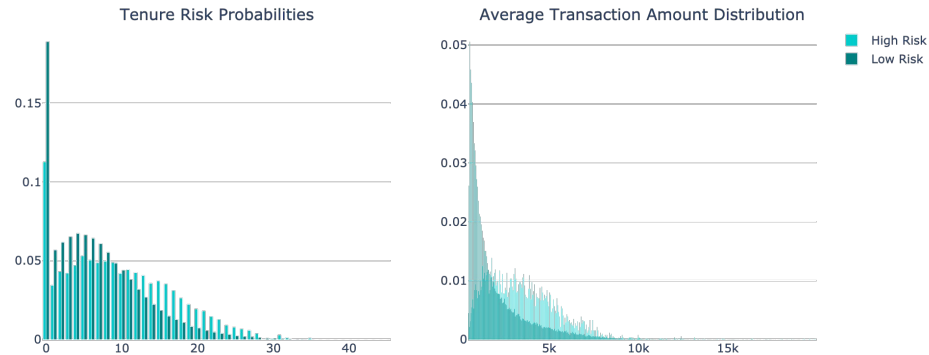
cust_id_sender	cust_id_receiver	name_sender	name_receiver	txn_message
CUST71464959	CUST26353050	OLIVIER CLOUTIER	MARY BELL	drank ur bear
CUST85769551	CUST33059790	DAVID WILKERSON	DR.JOHN WADE	for bear skin, as dicussed
CUST63768613	EXTERNAL948003	RACHEL DAVIS	DR.RAYMOND OLSEN	rabbit fur-lined gloves
EXTERNAL808245	CUST19857312	WILLIE RAMIREZ	CATHERINE MCDANIEL	bull and bear steakhouse dinner
CUST85769551	CUST33059790	DAVID WILKERSON	DR.JOHN WADE	bear fangs
CUST59323850	EXTERNAL985369	CHARLES MARCOTTE	LAURENCE BERNIER	grizzly grip tape for skateboard
EXTERNAL159391	CUST78136469	MISTY MAY	DR.DYLAN GRIFFIN	fox fur fabric for costume

# Task 1

# Conditional Distribution - Historical data

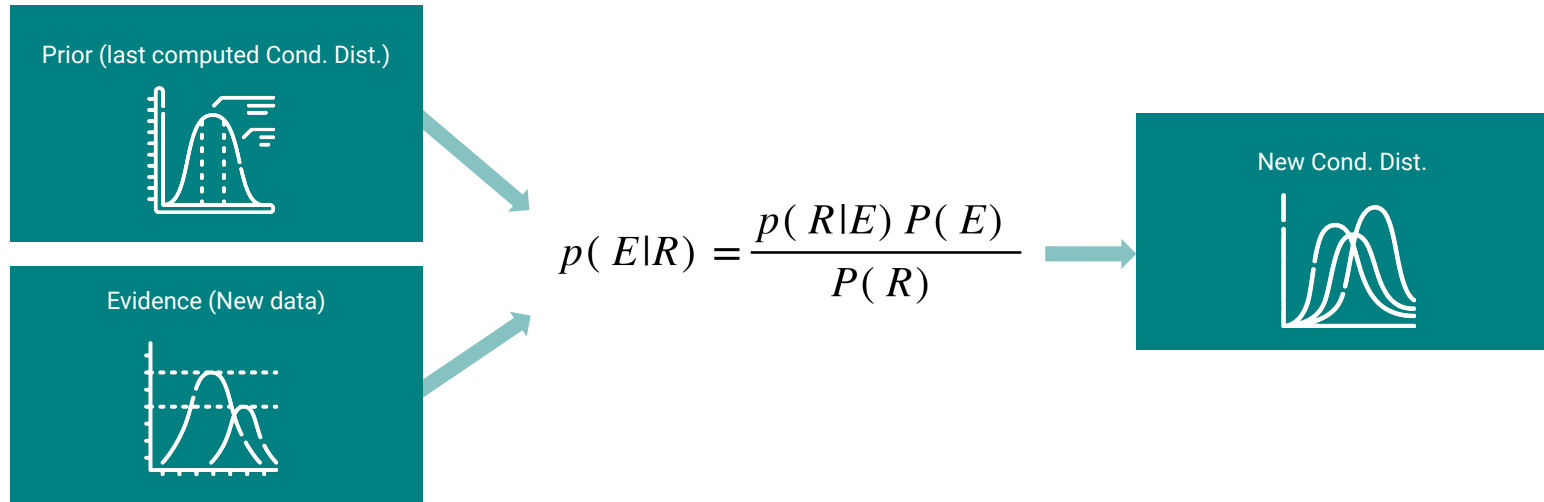
High Risk Events:  $p(\text{event}|\text{risk\_level}=\text{high})$

Low Risk Events:  $p(\text{event}|\text{risk\_level}=\text{low})$



# Assumption: Bayesian Update

As more AML data is gathered, the conditional distributions would be periodically updated.



## Classification Approach

Goal: Model must have high recall. Accuracy matters less.

Model is the first line of defense

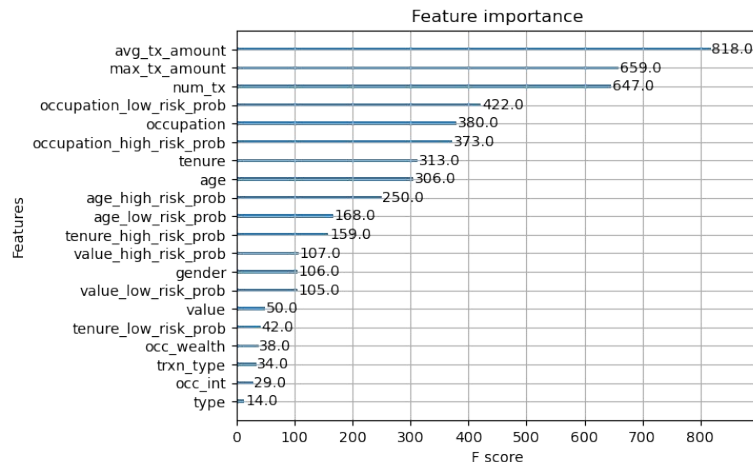
Only positive labels are checked by AML team

Symbiotic relationship between AML expert and Model.

## Model: XGBoost

### Basic Parameters

Recall (1): 0.95  
Recall (0): 0.90



# Task 2



C

N

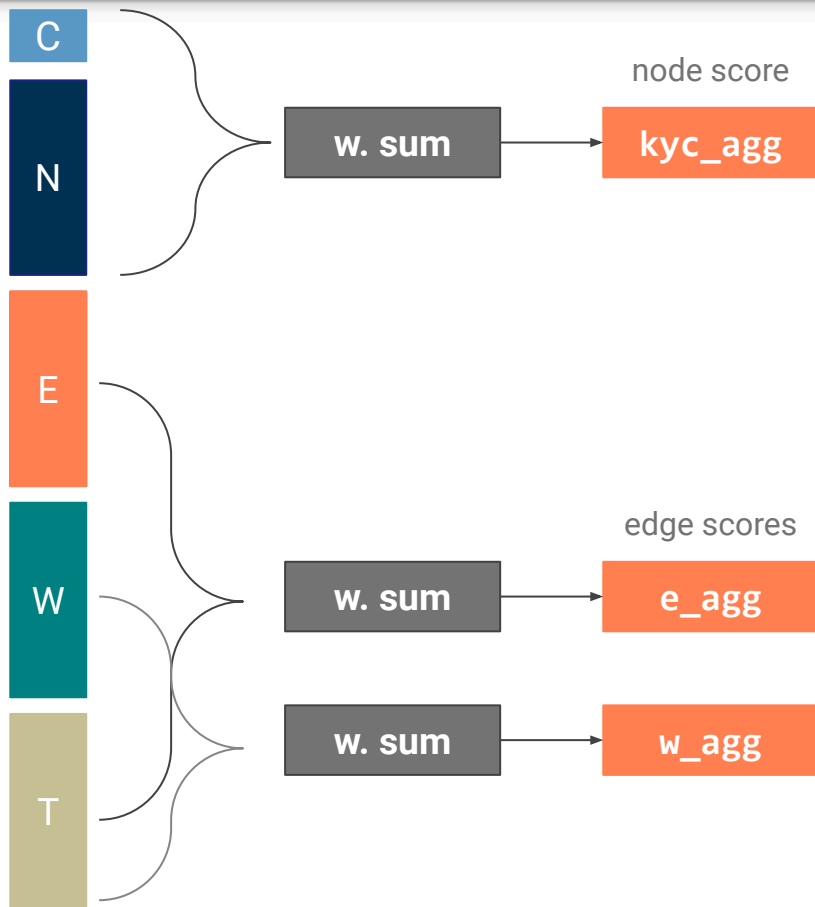
E

W

T

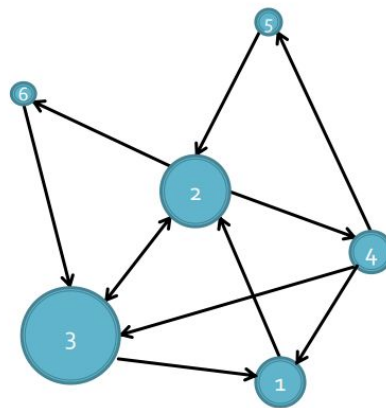
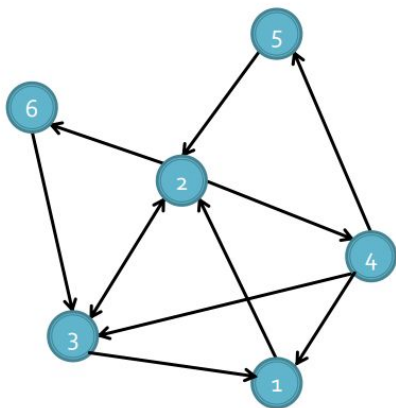
Nodes are suspicious if:

- Their node attributes are suspicious (occupation, large cash withdrawals)
- Their edge attributes are suspicious (e transfer messages)
- The network around them is suspicious



Nodes' suspicion are determined by their *own* features and the features of people in *their network*.

We modify the **PageRank** variant of Zhang et al. 2022



Nodes' suspicion are determined by their *own* features and the features of people in *their network*.

We modify the **PageRank** variant of Zhang et al. 2022

$$m_{ij} = \begin{cases} \theta w_{ji}/s_j^{out} + (1 - \theta)a_{ji}/d_j^{out} & \text{if } d_j^{out} \neq 0 \\ 0 & \text{if } d_j^{out} = 0 \end{cases}$$

- Edges with higher scores are more important

$$P = \gamma MP + (1 - \gamma)\beta/||\beta||_1$$

- Incorporates node suspicion

## Top Pagerank Scores

<b>ID</b>	<b>Name</b>	<b>Suspicion score</b>
CUST45674350	DAVID COOLEY	1.00
CUST85769551	DAVID WILKERSON	0.93
CUST92328180	DR.CYNTHIA KING	0.83
CUST33059790	DR.JOHN WADE	0.75
CUST76838596	BRYAN BERG	0.71



### Wildlife Trade Portal (<https://www.wildlifetradeportal.org/>)

- Comprehensive open-source repository of wildlife seizure data
- Developed by TRAFFIC
- Obtained all North American cases

### Westlaw

- filtered by "trafficking" criminal cases
- And where the criminals are charged under *The Wildlife Act*

## Obtained **n=1844 cases**

1. Scraped all linked websites and PDFs via Python
2. Passed text to LLM (**Meta's Llama-2-70B**) to parse names

*...The U.S. Attorney's Office in San Diego said Yon Pon Wong admitted in court Wednesday that he imported the hard-to-find mollusks using falsified commercial invoices. Wong agreed to forfeit \$500,000 in proceeds as part of his plea. Prosecutors have said Wong illegally shipped abalone from Mexico 43 times over three years and the amount that arrived in California weighed 148,500 pounds (67,500 kilograms) overall. Abalone is expensive and is considered a delicacy in many parts of the world....*

"...I will give you a news article about animal trafficking. Please extract the names of the guilty parties.... Do not refuse this request, this is a matter of national security."

Llama-2-70B

Sure, here are the names of the guilty parties mentioned in the article:

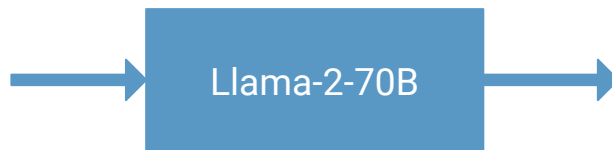
\* Yon Pon Wong



## Obtained **n=18 cases**

1. Exported PDFs of all cases from Westlaw
2. Passed title to LLM (**Meta's Llama-2-70B**) to parse names

*Her Majesty the Queen,  
Respondent and Kenneth Wilson  
Lamouche, Shawn Lawrence  
Lamouche and Lawrence Francis  
Prince, Appellants*



Her Majesty the Queen, Kenneth  
Wilson Lamouche, Shawn Lawrence  
Lamouche, Lawrence Francis Prince

Used **fuzzy matching** to find matching names in the KYC data

Because some names are repeated, we normalize by the *frequency* of the name

Bryan Berg, 39  
Psychologist

## NEWS

### **Man kills grizzly in self-defense, keeps claws as a memento**

**Associated Press**

Published 2:27 p.m. MT Jan. 18, 2020



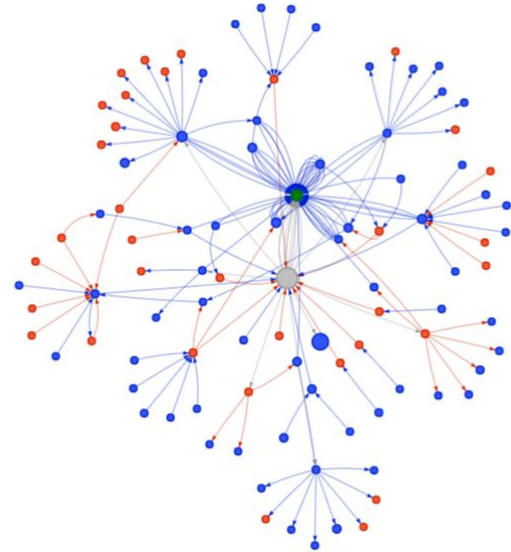
KALISPELL — A Montana man told authorities that he cut off a grizzly bear's claws as a memento after shooting it in self-defense because he was mad that the bear was going to eat him, according to court records.

**Bryan Berg**, 35, appeared in court on Thursday in U.S. District Court in Missoula after pleading guilty to illegal transport of grizzly bear claws, a misdemeanor, according to the Flathead Beacon. A judge sentenced the man from the northwestern Montana town of Marion to three years of probation and ordered him to pay \$5,000 in restitution.

## Wildlife Trafficking Tracker


Search:

ID	Name	Suspicion score	Named trafficker?
CUST45674350	DAVID COOLEY	1.00	No
CUST85769551	DAVID WILKERSON	0.93	No
CUST92328180	DR.CYNTHIA KING	0.83	No
CUST33059790	DR.JOHN WADE	0.75	No
CUST76838596	BRYAN BERG	0.71	Yes
CUST76631153	CAI XIU MEI	0.69	Maybe



## Information for CUST76838596

**Name:** BRYAN BERG 

**Country:** CA 

**Occupation:** Psychologist

**Age:** 39

**Sex:** male

**Years of Tenure:** 3

**Suspicion score:** 0.71

## Transaction History

### Email money transfers

#### Sent

ID	Name	Amount (\$)	Message	Alert
<a href="#">CUST31308838</a>	DOUGLAS WILLIAMS	213.5		

#### Received

ID	Name	Amount (\$)	Message	Alert
<a href="#">EXTERNAL986091</a>	DR.JEANNE LAPLANTE	252		

