

15-826: Multimedia (Databases) and Data Mining

Anomaly detection in large
graphs – types of fraud

Christos Faloutsos



Outline (for project)

- ✓• Patterns in graphs
- ✓• Anomaly detection
 - Types of fraud

From recent tutorial

- *Temporal Graph Mining for Fraud Detection*, by Faloutsos, Fidalgo, Cazzolato, ICDM 2023
- <https://mtcazzolato.github.io/tutorial-icdm23/> (has slides, AND [youtube videos](#))
- Same videos also [on CMU box](#)

Very useful for project

- (at least) 6 types of fraud ...
- ... and counting
- ('cat and mouse' ; 'whack a mole')

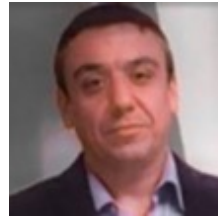


(image: from amazon.com)

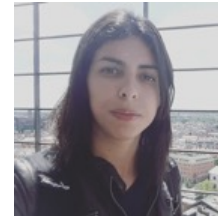
Temporal Graph Mining for Fraud Detection Part I



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USP

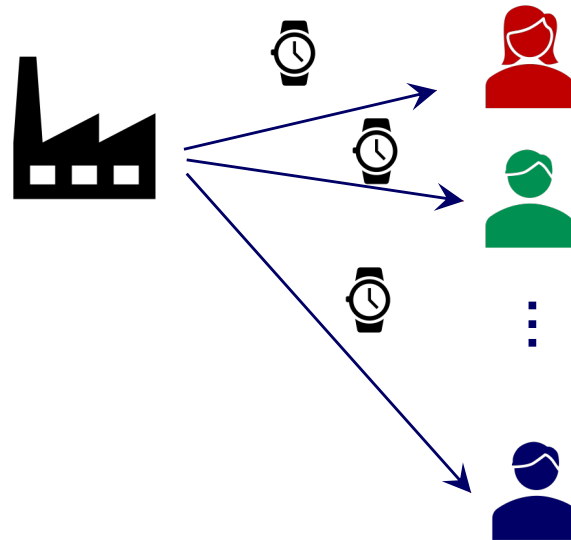
(multiple) types of fraud

- F1) E-commerce
- F2) Social networks
- F3) Phone-call graphs
- F4) Terrorism Networks (9/11)
- F5) Criminal Associations (Corruption)
- F6) Telecom Fraud (Credit Cards)
- ...

The Many Faces of Link Fraud, Neil Shah, Hemank Lamba, Alex Beutel, Christos Faloutsos, [arxiv](#)

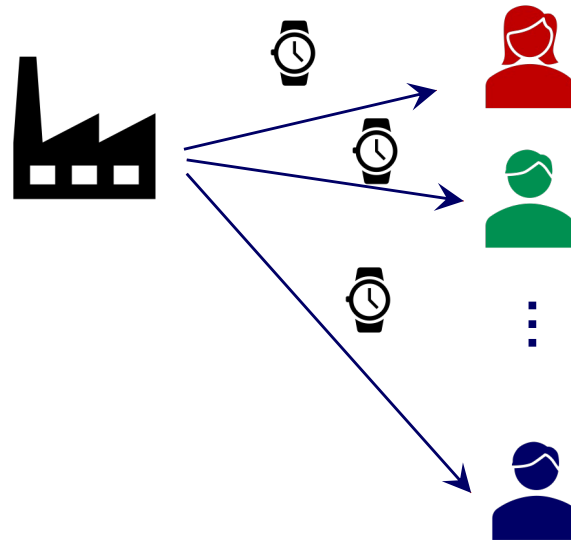
F1: Fraud in e-commerce

- ‘brushing’ ([Wikipedia](#); [WSJ](#))
 - Un-wanted packages – WHY?



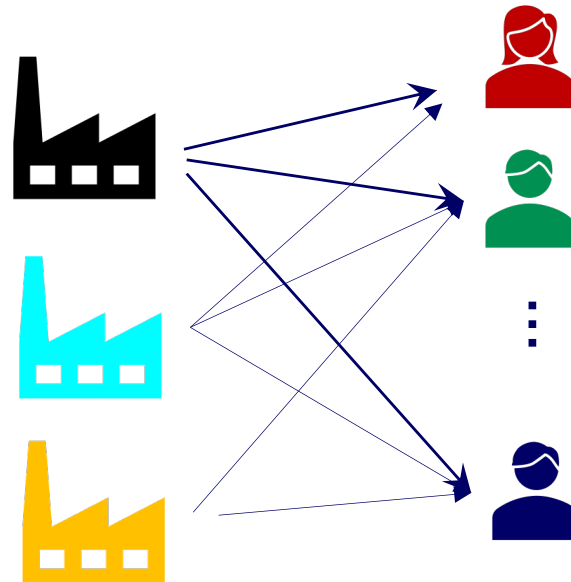
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F1: Fraud in e-commerce

- ‘brushing’ ([Wikipedia](#); [WSJ](#))
 - Un-wanted packages, to boost ‘sales’
- Buyer-seller collusion
- ...



F2: Fraud in social networks

- Fake twitter followers



I will follow you
@TwitterFollower

Follow us, we follow you. Unfollow us, we unfollow you. Want another follower? Click the link above. To contact, DM @GetFollowed

📍 USA 🔗 twitter.com/IWillFollowYou

8,004 FOLLOWING 6,967 FOLLOWERS

Tweets Media Favorites



I will follow you @TwitterFoll... 7/24/09

Check out how I got 500 followers in ONE day! <http://www.extrafollowers.com>

↩️ ↻ 20 ★ 13 👤

how to buy twitter followers

Videos For free Online On OWLET Fake Reddit Images News Shopping

About 236,000,000 results (0.35 seconds)

Sponsored

 Social Crow
<https://www.socialcrow.co>

Buy Twitter Followers - \$0.02 Per Follower

Buy Twitter Followers & more, fast with no sign up required. Taking you to the next level! Get followers, likes, comments or video views at...

People also search for

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buy twitter followers 2023	buy twitter followers reddit
best site to buy twitter followers	buy 10,000 twitter followers
buy twitter followers cheap	buy 1000 twitter followers

Sponsored

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<https://www.twenvy.com> • free-trial

Buy Twitter™ Followers - Plans Starting at \$69/week

Grow Your Twitter™ Account by 5,000 Followers Every Month. No Password Required. 100% Organic Growth. Highly-Targeted Followers.

Sponsored

 Viewpals
<https://www.viewpals.co>

Get Real Twitter Followers - Instant Follower From \$0.99

We're Viewpals, the internet's most trusted provider of Twitter likes & followers. Get Twitter Followers top services to Twitter followers.

Sponsored

 socialopinon.org
<https://www.socialopinon.org>

Boost twitter followers - Get Real Followers On Twitter

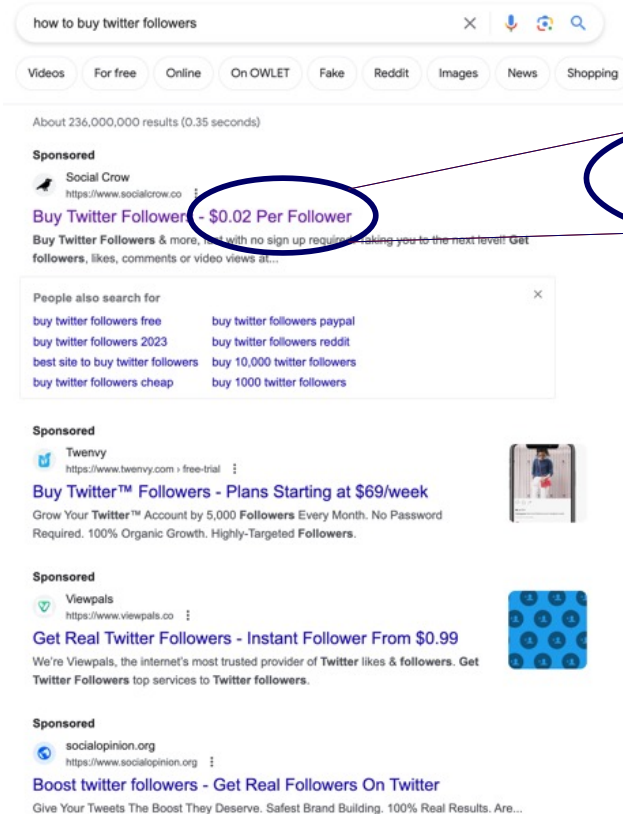
Give Your Tweets The Boost They Deserve. Safest Brand Building. 100% Real Results. Are...

\$ Per Follower??

FRAUDAR: Bounding Graph Fraud ...; B. Hooi, H.A. Song, A. Beutel, N. Shah, K. Shin, C. Faloutsos, KDD 2016 (best paper)

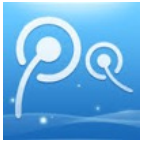
F2: Fraud in social networks

- Fake twitter followers

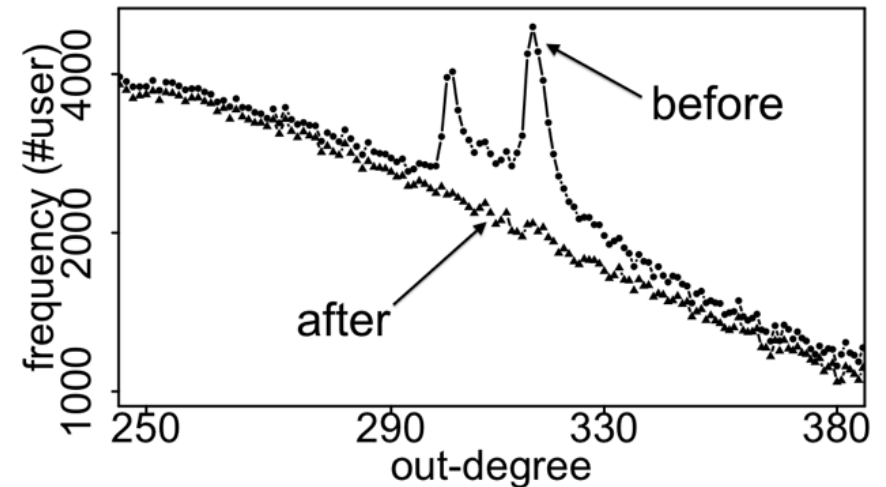
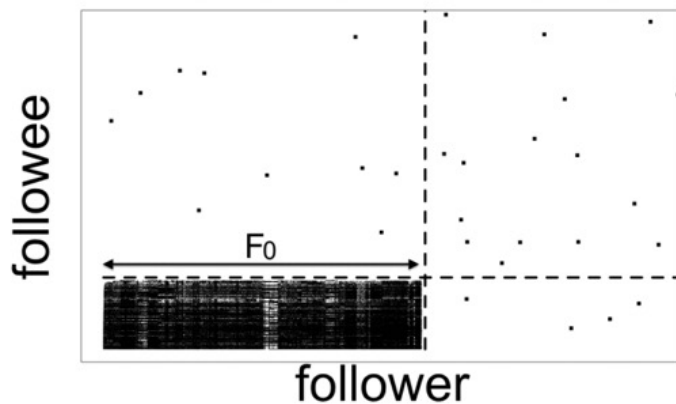


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F2: Fraud in social networks



“Block”

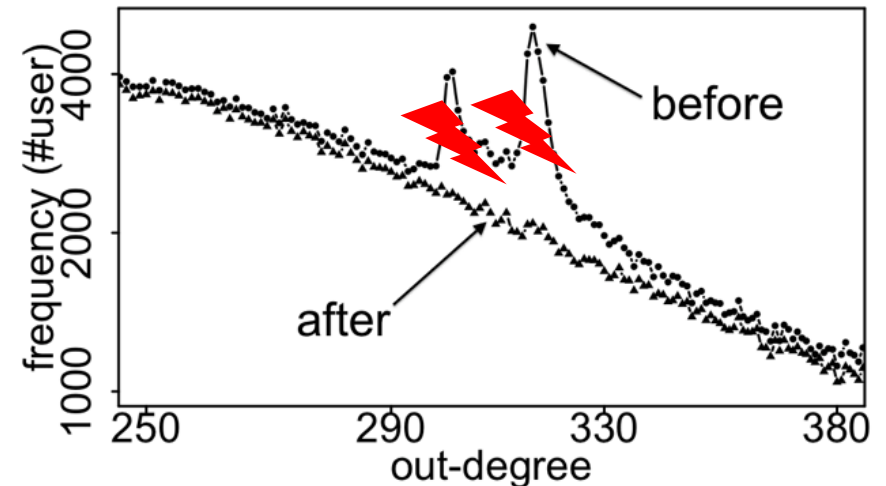
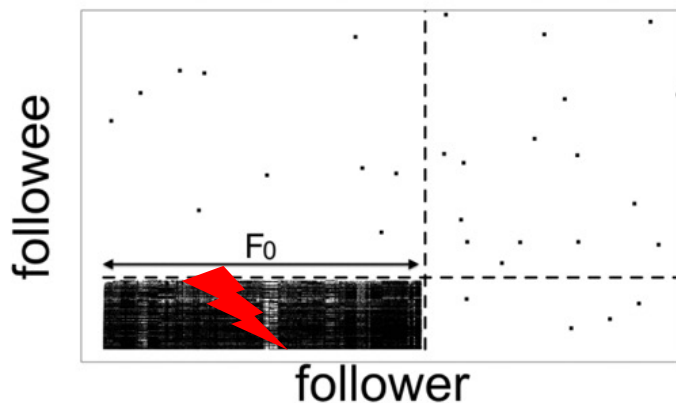


Inferring Strange Behavior from Connectivity Pattern in Social Networks; Meng Jiang, Peng Cui, Shiqiang Yang, Alex Beutel, Christos Faloutsos; PAKDD'14

F2: Fraud in social networks



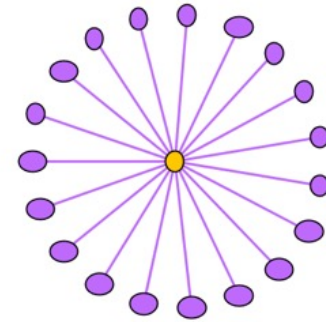
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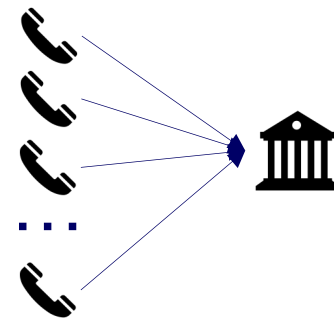
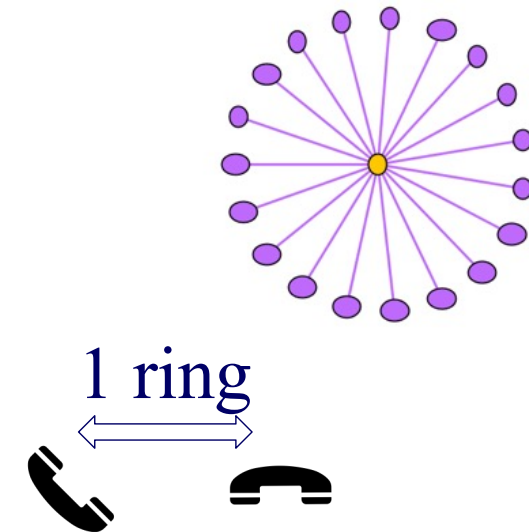
F3) Phonecall graphs

- Telemarketers
- Other types of fraud?



F3) Phonecall graphs

- Telemarketers
- ‘wangiri’ ‘one-ring scam’
 - [Europol](#); [AT&T](#)
- Telephony Denial of Service (TDoS)([DHS](#))

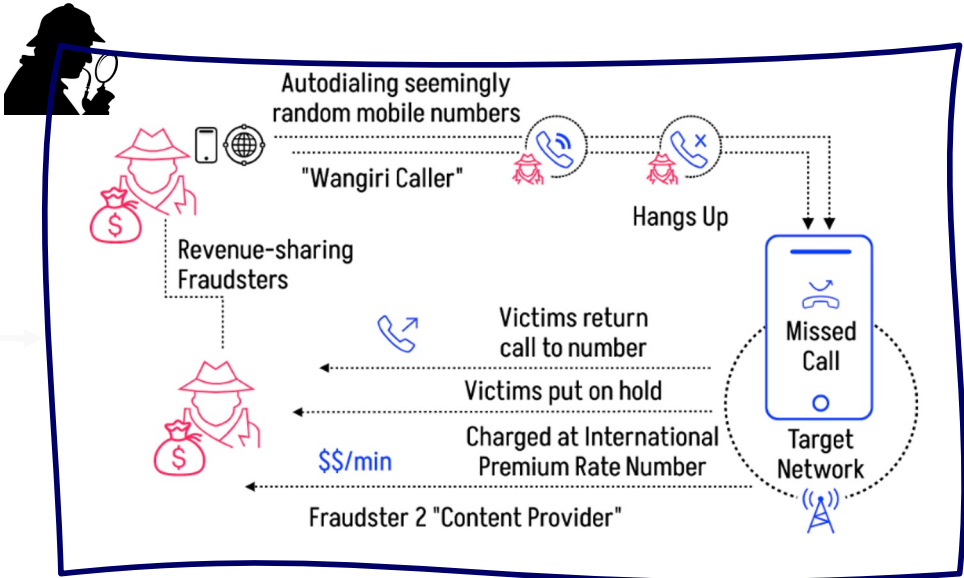




Fraudulent Behavior: *"Know Thy Enemy"*

Indicator signs for some of the fraudulent behaviors.
 +(/-) means abnormally high(/low).

	out-degree	in-degree	in-weighted-deg.	out-weighted-deg.	in-call-count	out-call-count	IAT	density
Fraud Type								
Revenue Share (IRSF)	+	-	-	+		+		
Arbitrage	+	-	-	+		+	-	+
Voice Interconnect Bypass	+		-		-	+	-	+
Fraud Method								
CLI Spoofing	+			+				-
Wangiri	+			+		+		
Robocalling	+	-		+				+

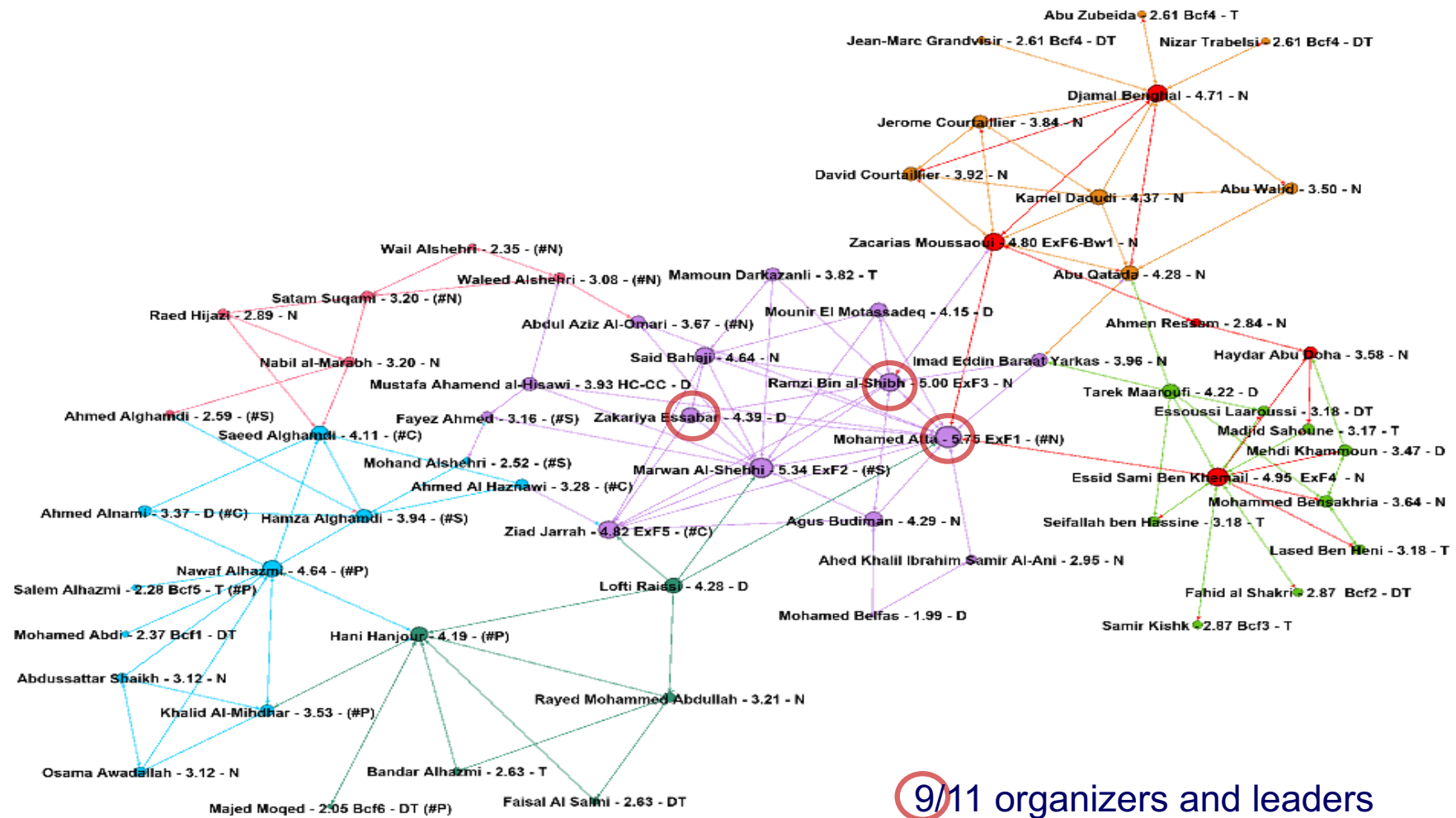




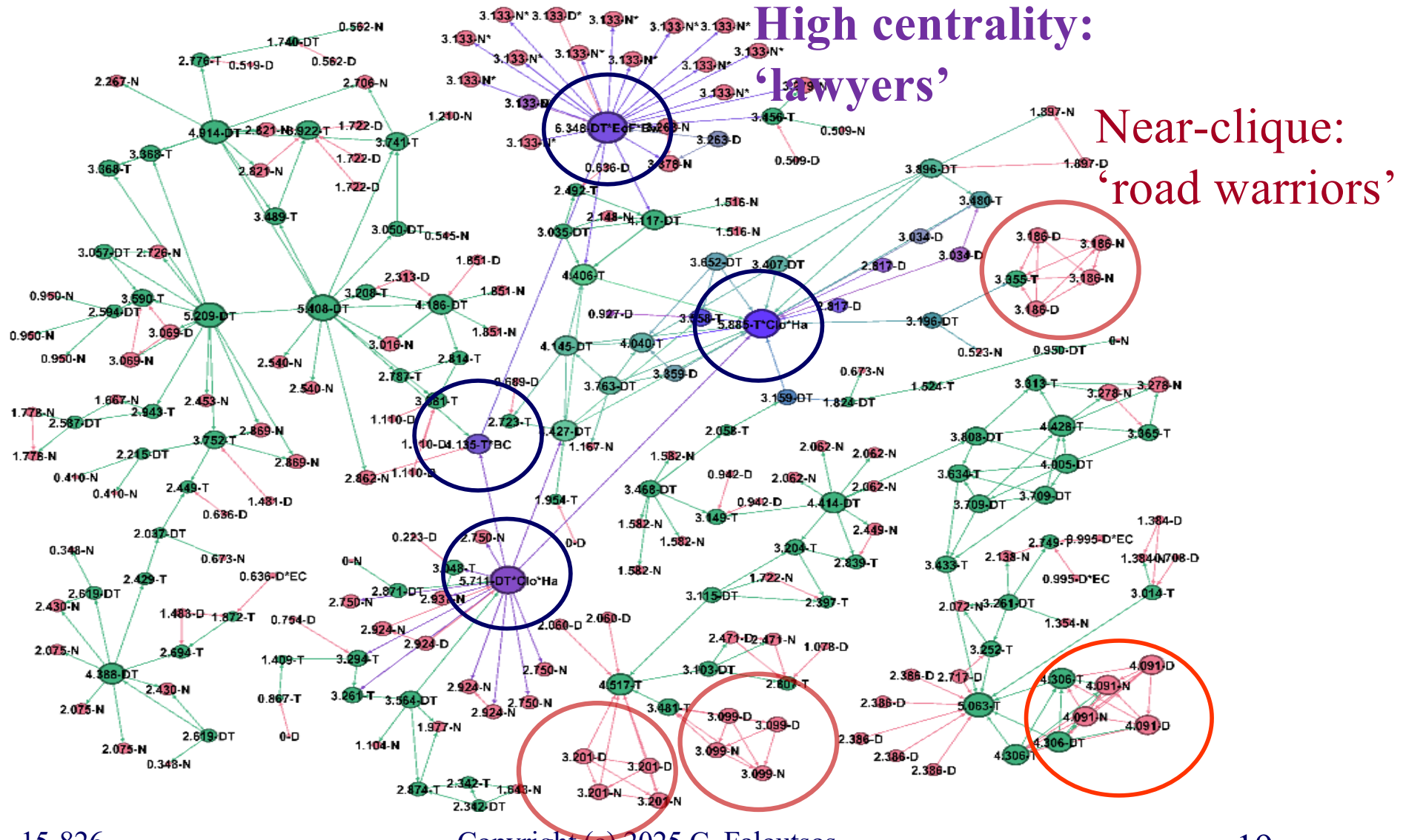
Fraudulent Behavior: *"Know Thy Enemy"*

	<i>out-degree</i>	<i>in-degree</i>	<i>in-weighted-deg.</i>	<i>out-weighted-deg.</i>	<i>in-call-count</i>	<i>out-call-count</i>	<i>IAT</i>	<i>density</i>
Fraud Type								
Revenue Share (IRSF)	+	-	-	+		+		
Arbitrage	+	-	-	+		+	-	+
Voice Interconnect Bypass	+		-		-	+	-	+
Fraud Method								
CLI Spoofing	+			+				-
Wangiri	+			+		+		
Robocalling	+	-		+				+

F4) Terrorism Networks (9/11)

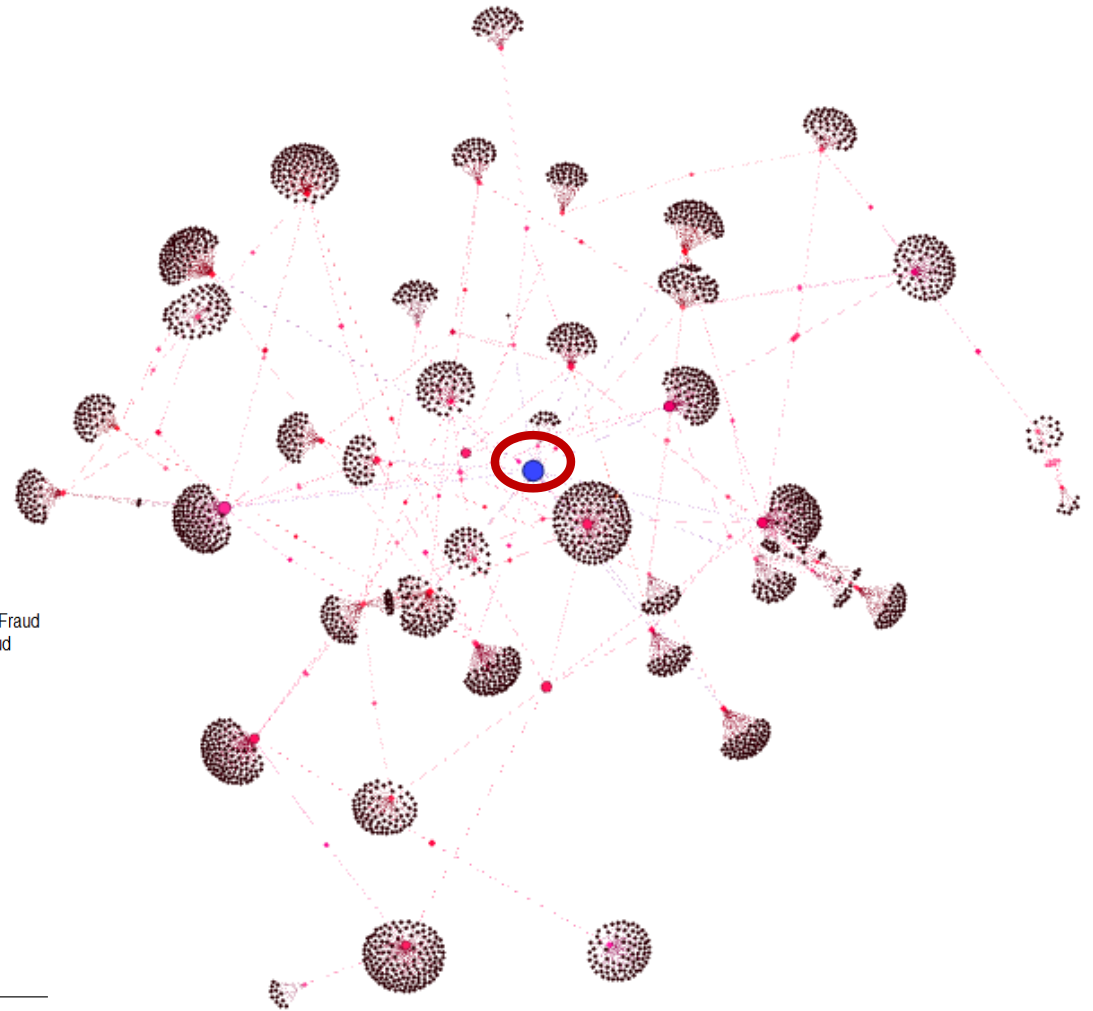
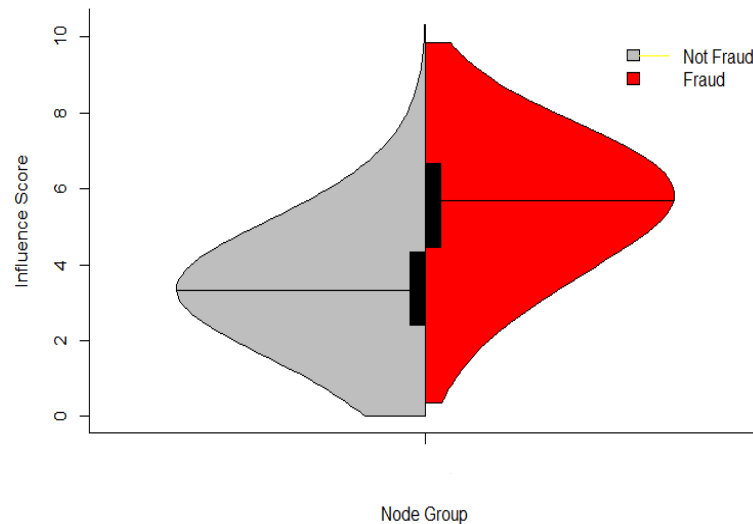


F5) Criminal Associations (BFP)



F6) Telecom Fraud (Credit Cards)

- Bridge nodes with low degree
- Interconnected Hubs
- Strategic position
- High Influence
- Roles in the network (Control)



StarBridge: a topological multidimensional subgraph analysis to detect fraudulent nodes and rings in telecom networks. Pedro Fidelis, Rui

Very useful for project

- (at least) 6 types of fraud ...
- ... and counting
- ('cat and mouse' ; 'whack a mole')



(image: from amazon.com)