



Insider Threat Detection

A Heuristic Network-Based Approach

Ph.D. Program in
Computation,
Organizations
& Society

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An insider threat is an individual or group with access to an organization's essential network, systems, or data, that deliberately abuses their access for malicious purposes. The 2014 US State of Cybercrime survey states that up to 46% of electronic crimes were committed by insiders, and 37% of cases could not be referred for legal action because the organization could not identify the individual or individuals responsible for the cybercrime. Therefore, the aim of this study was to determine the utility of five different communication-based feature sets through the use of a rule-based machine learning algorithm to detect and mitigate insiders within an organization.

Methodology

1) Obtain Enron Corpus

2) Corpus to Network Transformation

3) Feature Sets Extraction

Network Metrics

Network Metric Deltas

Group-Level Communication Features

Group-Level Communication Deltas

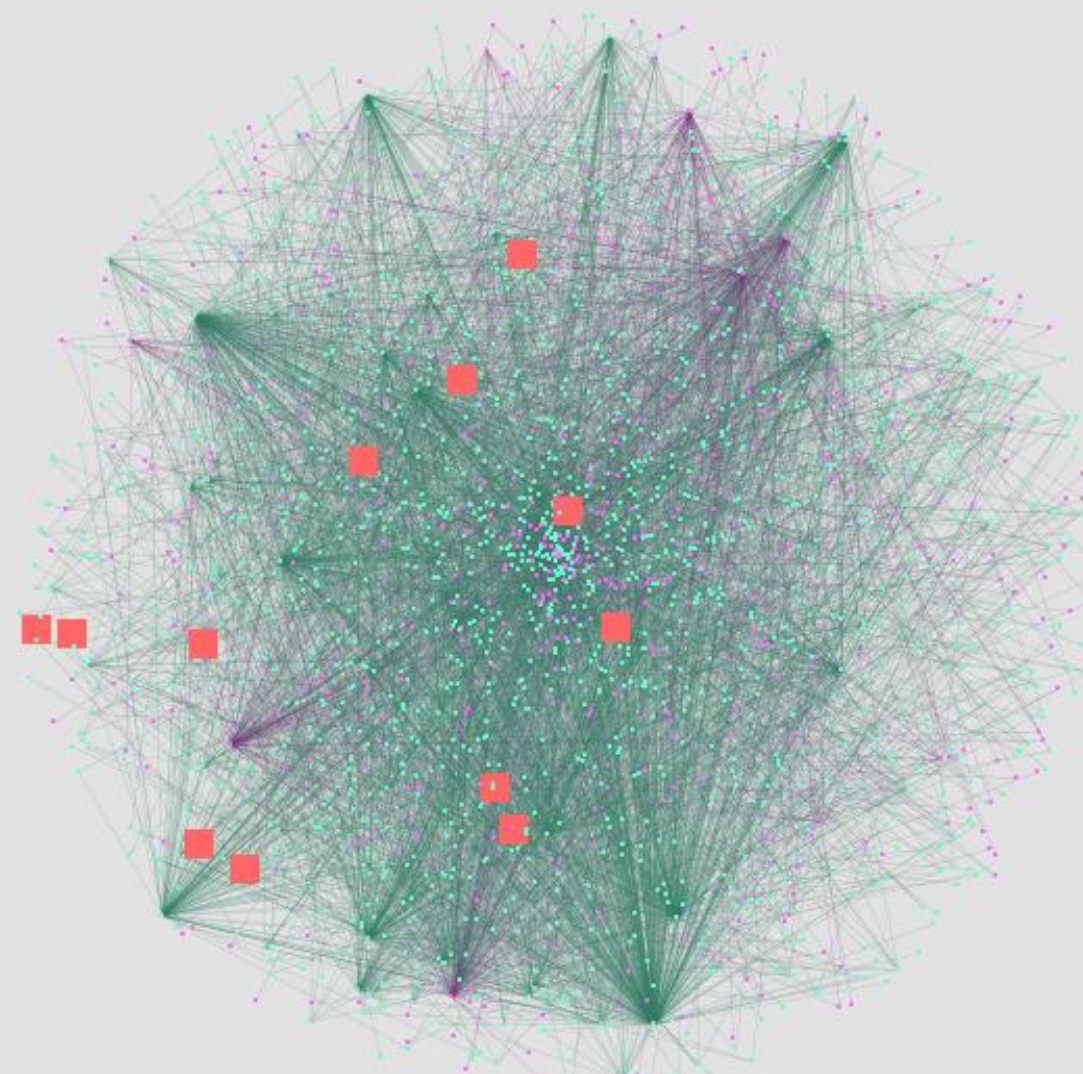
Content Metrics

4) Machine Learning and Analysis of Results

- JRip in Weka used to create receiver operator characteristic curve for each feature set through five-fold cross validation
- Cost of missing insider was adjusted through cost-sensitive meta-classifier to produce table of false vs. true positives
- ROC curve produced to visualize utility of each feature set

Sample Enron Network Visualization

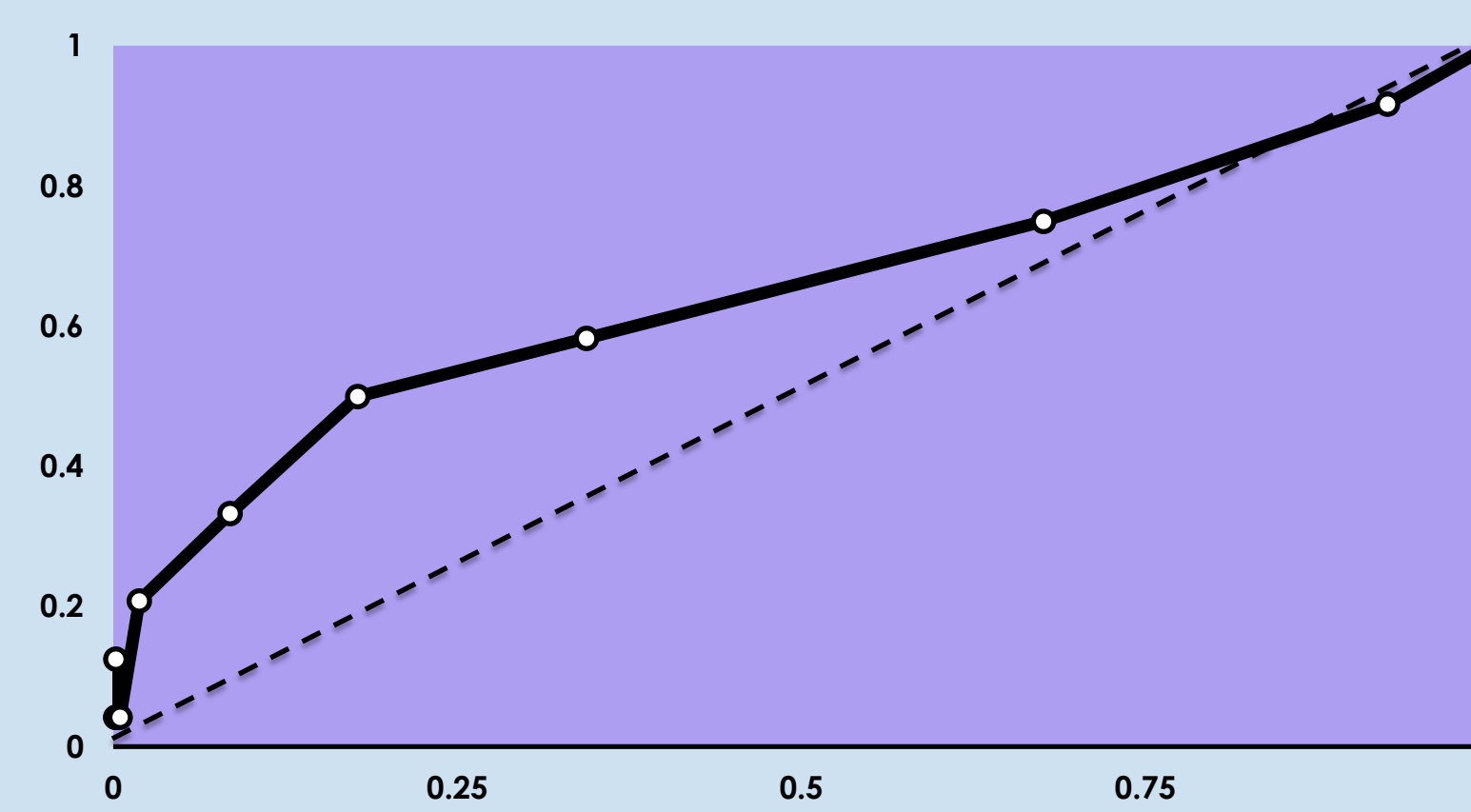
Enron - 2001-03-01



powered by ORA-NetScenes

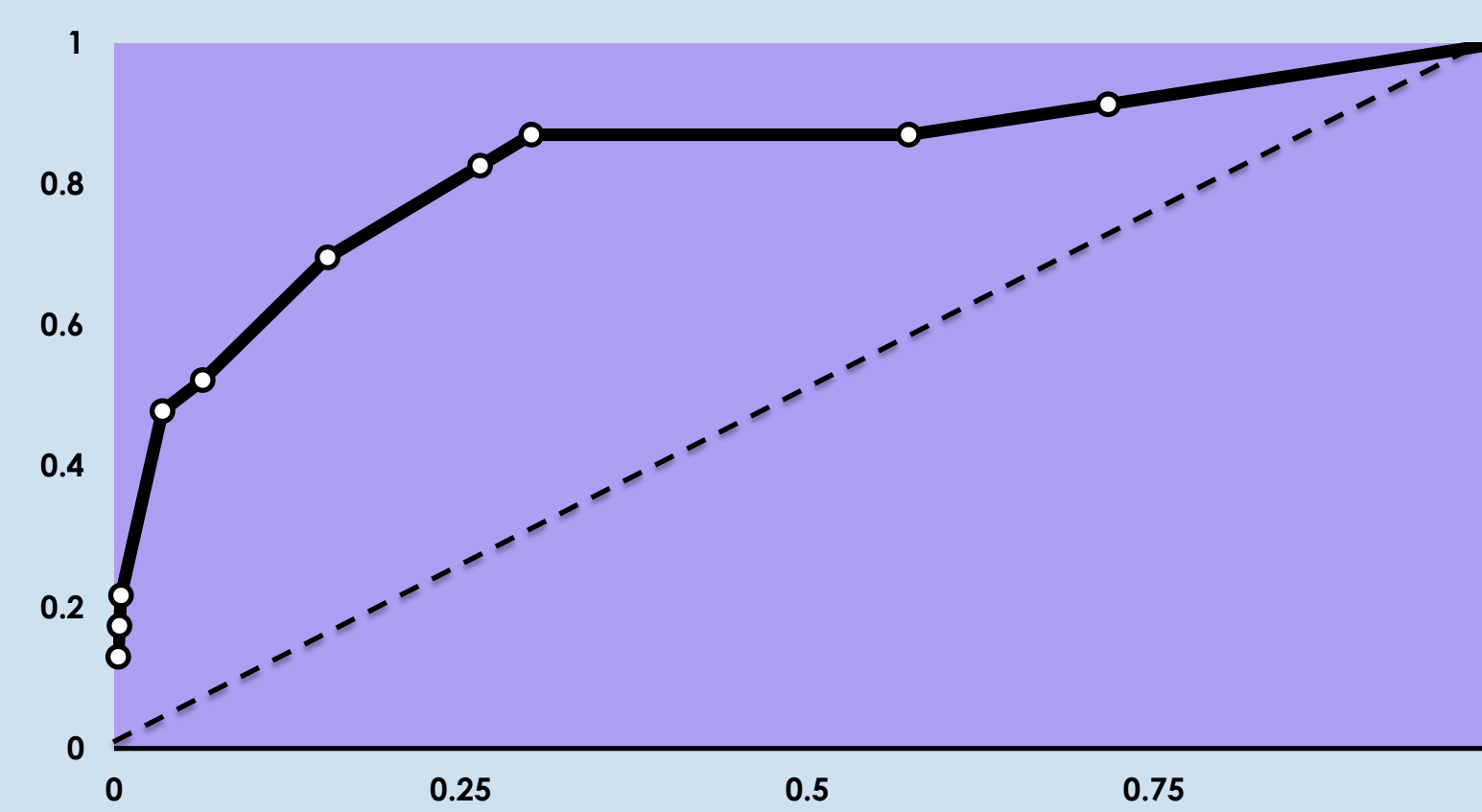
Results

Network Metrics



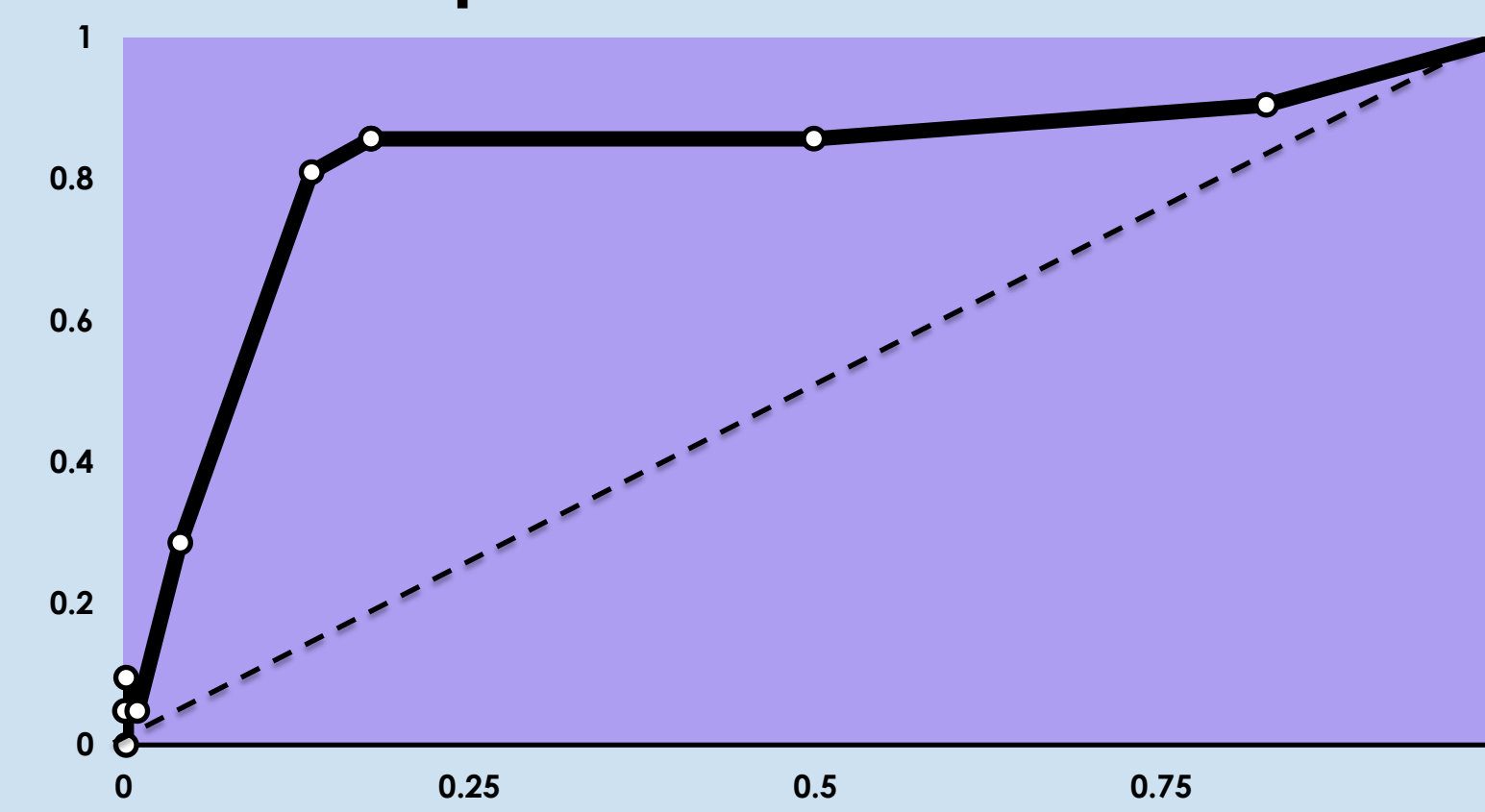
FP	TP
0.002	0.125
0.002	0.042
0.002	0.042
0.005	0.042
0.019	0.208
0.085	0.333
0.1777	0.5
0.344	0.583
0.676	0.75
0.926	0.917
1	1

Network Metric Deltas



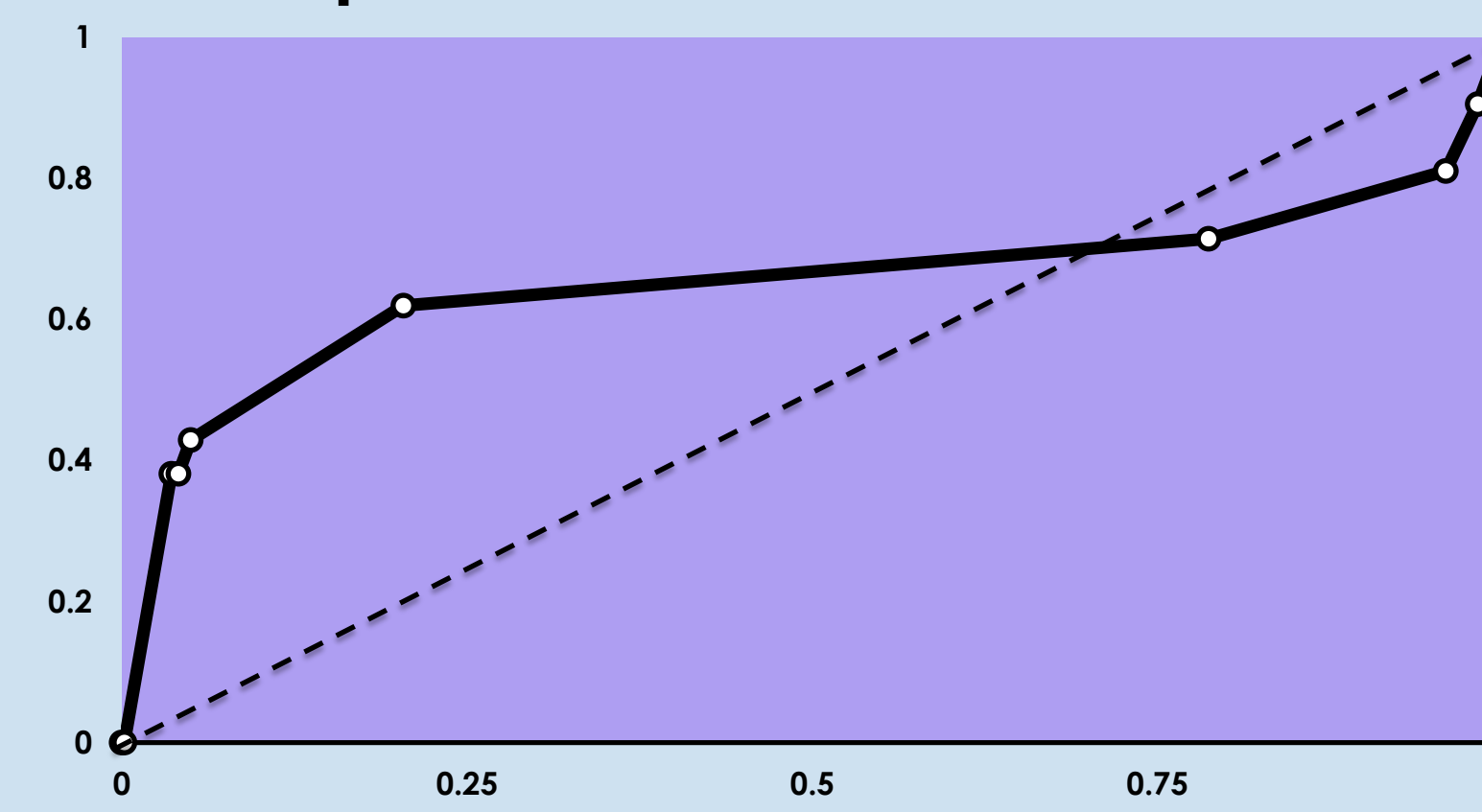
FP	TP
0.003	0.13
0.004	0.174
0.005	0.217
0.035	0.478
0.064	0.522
0.154	0.696
0.264	0.826
0.301	0.87
0.573	0.87
0.717	0.913
1	1

Group Level Communication



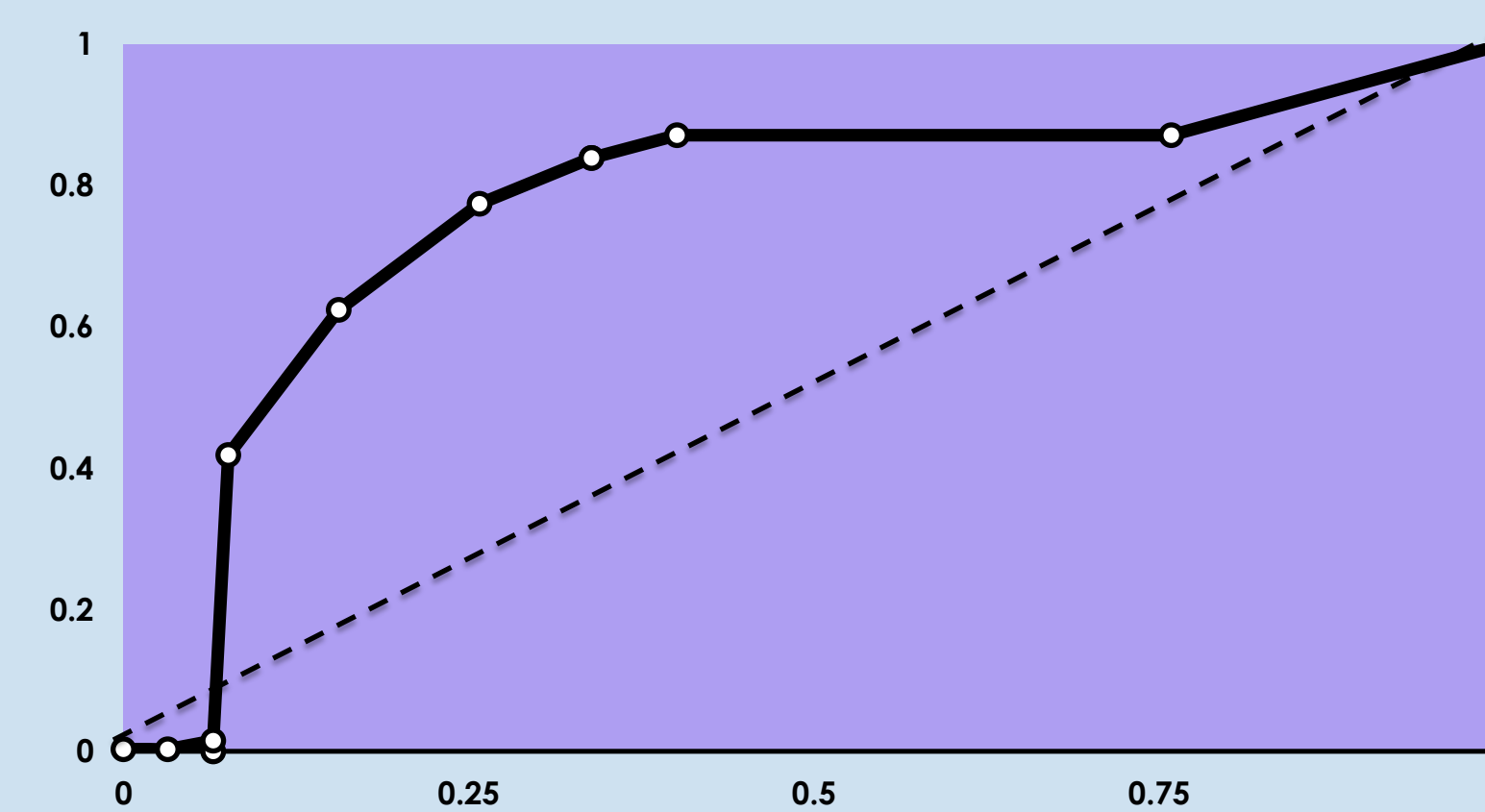
FP	TP
0.001	0.048
0.002	0
0.002	0.095
0.01	0.048
0.041	0.286
0.136	0.81
0.179	0.857
0.179	0.857
0.499	0.857
0.826	0.905
1	1

Group Level Communication Deltas



FP	TP
0	0
0.002	0
0.036	0.381
0.041	0.381
0.05	0.429
0.204	0.619
0.787	0.714
0.959	0.81
0.982	0.905
1	1

Content Metrics



FP	TP
0.065	0
0	0.003
0.032	0.003
0.065	0.015
0.076	0.419
0.156	0.624
0.258	0.774
0.339	0.839
0.339	0.839
0.401	0.871
0.759	0.871
1	1

This research presents a novel approach to insider threat detection through social network analysis and supervised machine learning, and demonstrates the utility of several feature sets that may be useful in insider threat mitigation.

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