#### Persistent Roles in Online Social Networks

ECML-PKDD 2016, M. Revelle, C. Domeniconi, and A. Johri

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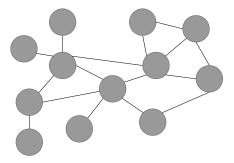
Introduction

Persistent Roles in Online Social Networks
Introduction

Introduction

### Social Network Analysis

The study of relationship between actors.



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Introduction

Social Network Analysis



Persistent roles should occur in any social network Based on the structure of the network Persistent Roles in Online Social Networks
Introduction

Persistent roles should occur in any social netvi Based on the structure of the network

# **Applications**

graph mining Targeted advertisement Persistent Roles in Online Social Networks

Introduction

Applications

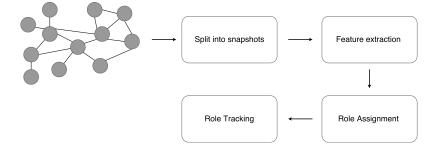
graph mining Targeted advertisement

Persistent Roles in Online Social Networks — Methodology

Methodology

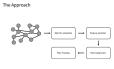
# Methodology

# The Approach



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└─The Approach



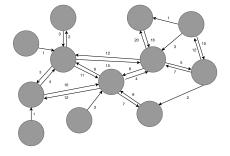
Feature-based approach

#### The Data

#### Datasets:

- Facebook Wall posts from one user to another
- Scratch Comments on uploaded programming projects

Directed, timestamps.



Persistent Roles in Online Social Networks

Methodology

\_\_\_The Data

The Data

Datasett:
- Facebook - Wall posts from one user to another
- Scratch - Comments on upfaceded programming projects
- Directed, firmestamps.



### Snapshot Split-up

The dataset is split into a total of 26 snapshots:

- 7 from facebook
- 19 from Scratch

Non-overlapping

Same length = observation window  $\Omega$ .

Something with node interaction being smaller than Omega. (90th percentile?)

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— Methodology

-Snapshot Split-up

Snapshot Split-up

The dataset is split into a total of 2d snapshots:

7 from facebook

19 from Scratch

Non-overlapping

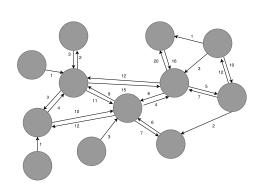
Same length = observation window Ω

Somethies with node infraraction being smaller than Omera. (90th

Methodology

#### **Feature Selection**

12 features based upon the graph.



in-degree
Out-degree
Weighted in-degree
Weighted out-degree
Reciprocity
New activity
Social strategy
Betweenness centrality
PageRank
Weighted PageRank
Transitivity
Weighted transitivity

In-dograp

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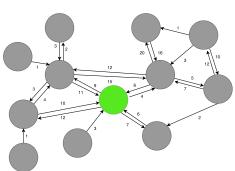
-Feature Selection



Feature Selection



# Feature Example

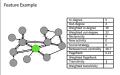


	In-degree	5	
	Out-degree	4	
	Weighted in-degree	36	
	Weighted out-degree	32	
	Reciprocity	4	
	New activity	0	
	Social strategy	0	
	Betweenness centrality	38.7	
	PageRank	0.21	
	Weighted PageRank	-	
	Transitivity	$\frac{1}{3}$	
	Weighted transitivity	-	

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Methodology

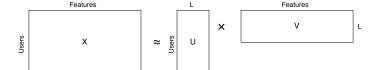
Feature Example



# Role Discovery and Membership

#### Non-negative Matrix Factorization

 $X \approx UV$ 



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Methodology

Role Discovery and Membership



- Frobenius NMF updated with euclidean distance
- U and V are initialized with left and right matrix from nndsvd (Modified svd)

Selection of L

Selection of L

#### Root Mean Squired Error

$$RMSE = \sqrt{\frac{1}{|X|} \sum_{(u,f) \in X} (X_{u,f} - X'_{u,f})}$$

# Tracing Roles

The sim between snapshots.

Persistent Roles in Online Social Networks Tracing Roles -Methodology ☐ Tracing Roles

The sim between snapshots.

Results

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Results

Results

Introduction Methodology **Results** C

#### Persistent Roles

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Results
Persistent Roles

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#### **Role Transition**

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Results

Role Transition

Conclusion

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Conclusion

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Conclusion

# Shortcomings

They does not argue for their selection of features or give a reference to an article that does.

Number of snapshots.

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Conclusion

Shortcomings

Shortcomings

They does not argue for their selection of features or give a reference to an article that does.

Number of snapshots.