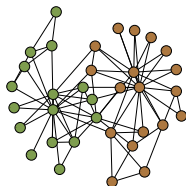# EXPLORATORY AND PREDICTIVE TASKS OF NETWORK COMMUNITY DETECTION
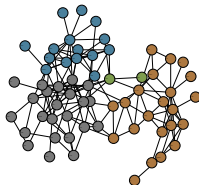
Lovro Šubelj

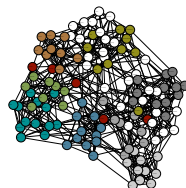University of Ljubljana, Slovenia

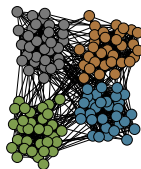NetSci '15

NETWORK COMMUNITY STRUCTURE
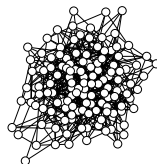

Karate club

Bottlenose dolphins

American football

Synthetic graph

Random graph

Let communities be non-overlapping cohesive subgroups of sparse networks.
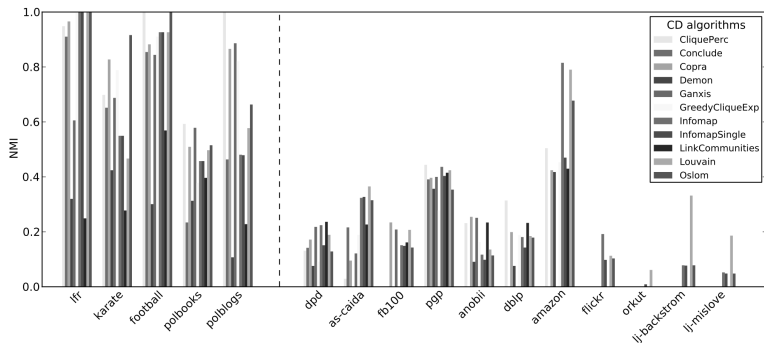
NETWORK COMMUNITY DETECTION

Classes of methods:

- graph partitioning,
- hierarchical clustering,
- modularity optimization,
- statistical inference,
- spectral methods,
- map equation,
- dynamics etc.

Fortunato, S., *Phys. Rep.* **486**, 75–174 (2010).
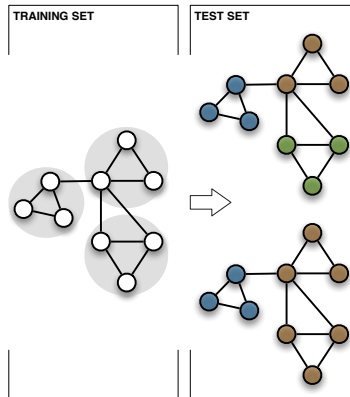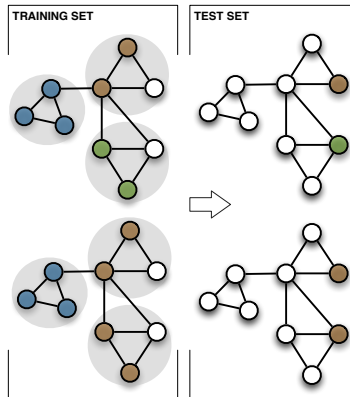
LARGE-SCALE COMMUNITY DETECTION

Hric, D., Darst, R. K. & Fortunato, S., *Phys. Rev. E* **90**, 062805 (2014).

COMMUNITY DETECTION TASKS

EXPLORATORY TASK

TRAINING SET   TEST SET

PREDICTIVE TASK

TRAINING SET   TEST SET

APS & WIKILEAKS NETWORKS

	APS	WikiLeaks
DATA	1893-2013	1966-2010
NETWORK	citation 526,527 papers 5,989,263 citations	reference 52,416 cables 78,506 references
CLUSTERS	12 journals 301 sections	3 privacy levels 263 embassies
SETTING	14 methods	26 methods
TRAINING	1893-2012	1966-2009
TEST	2013 (4%)	2010 (17%)

Non-overlapping and cohesive ground truth clusters.

APS & WIKILEAKS RESULTS
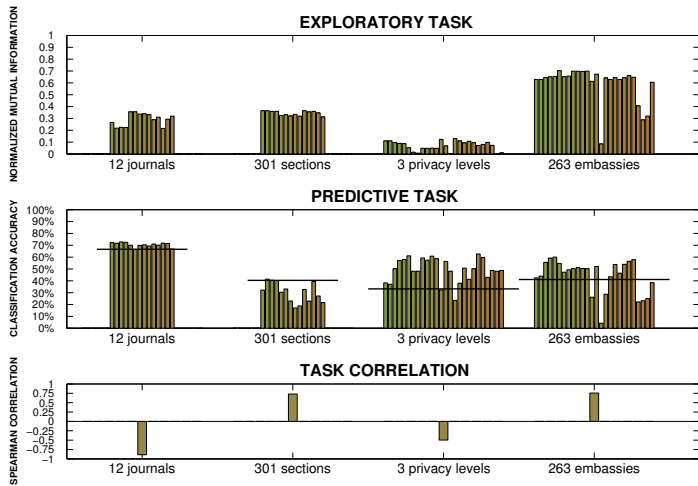
DBLP, YOUTUBE & JAVA NETWORKS

DATA	DBLP	YouTube	java
NETWORK	collaboration 317,080 authors 1,049,866 collabs.	social 39,841 users 224,235 friends.	software 2,378 classes 14,619 depends.
CLUSTERS	98,326 venues	12,986 groups	54 packages
SETTING TEST	14 methods leave-one-out	14 methods leave-one-out	26 methods leave-one-out

Overlapping or non-cohesive ground truth clusters.

DBLP, YOUTUBE & JAVA RESULTS
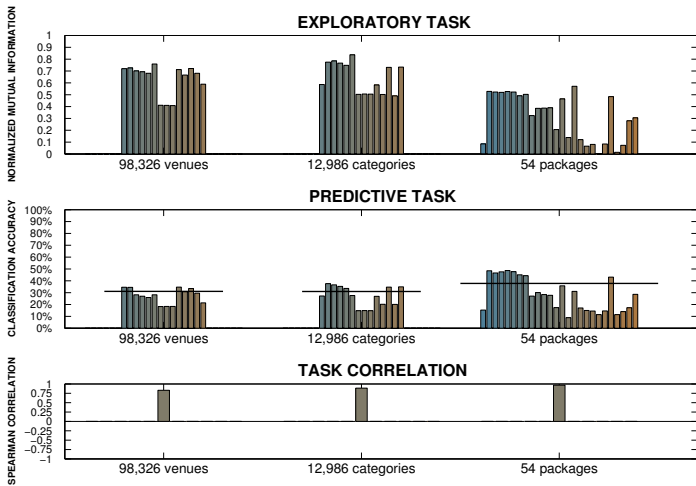
COMMUNITY DETECTION IN PRACTICE

Take-home message:

- community information **is** useful for prediction,
- for lots of clusters, same methods for both tasks,
- for few clusters, different methods for different tasks.

Possible collaboration:

- beyond simple two-step classification,
- overlapping and non-cohesive clusters,
- descriptive, inferential, causal and mechanistic tasks.

Leek, J. T. & Peng, R. D., *Science* **347**, 1314-1315 (2015).

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