HOW TO LEARN MORE FROM KNOWLEDGE NETWORKS THROUGH SOCIAL NETWORK ANALYSIS MEASURES

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1. STUDIO – Short introduction
2. From Knowledge Networks to Social Networks and back
3. Experimenting with Network Measures
4. Outlook
Ontology-based educational self-assessment

TECHNOLOGY ENHANCED LEARNING: THE STUDIO APPROACH

With STUDIO we can build a knowledge graph.
The Domain Ontology and the Test Material

Domain Ontology as Knowledge Structure

Test Questions: As a driver for testing

Knowledge Repository: Learning material

20 THINGS YOU CAN DO TO SAVE ENERGY

Whenever you save energy, you not only save money, you also reduce the demand for such fossil fuels as coal and natural gas. Less burning of fossil fuels also means lower emissions of carbon dioxide (CO2), the major contributor to global warming, and other pollutants.

Home appliances

Turn your refrigerator down. Refrigerators account for about 20% of Household electricity use. Use a thermometer to set your refrigerator temperature as close to 37 degrees and your freezer as close to 3 degrees as possible. Make sure that its
How to Learn More from Knowledge Networks Through Social Network Analysis Measures

Testing

Result Reflection

Learning

Blended Learning

Learning Loop
STUDIO Domain Ontology = Multiple Domains

Full Domain Ontology

- > 2000 Concepts + LM
- ~ 5000 Questions
- **Profit**: Many possible learning units

→ Environment and Protection Domain
Tailoring the ontology “fit for purpose”

Power of the Ontology

vs.

Extend the Learner can Learn

- Selecting the relevant concepts for a learning task
- How to make use of content, structure and the design decision?
http://apps.cytoscape.org/apps/cytonca
Network Analytics: Using Centrality Measures

http://apps.cytoscape.org/apps/cytonca

http://tim.jagenberg.info/2015/01/
Centrality Measures: Applications in Different Fields

IT Project Portfolio Management

IT Landscape Management Using Network Analysis - Daniel Simon, Kai Fischbach
Centrality Measures: Applications in Different Fields

Web-page ranking with PageRank

http://computationalculture.net/article/what_is_in_pagerank
A little Exploration with Network measures

EXPERIMENTING WITH GRAPH MEASURES: THE NURSING DOMAIN
Sub-Domain in the Field of Nursing

- 117 concepts
- 3 main fields:
  - Medicine / Biology / Psychology
- Based on the Nursing Processes
  - Clear rational:
  - Structure and test become more detailed while drilling deeper
What is **Degree Centrality**?

- The number of incoming and outgoing connections per node.

How well connected are nodes.
Degree Centrality for Nursing

- The number of connections per node.
- How well connected are nodes.
- How dependent of each other are nodes – especially based on the outgoing degree.
What is **Betweenness Centrality**?

How often a node is part of a shortest path between nodes.


‘Bridges’ or ‘Gates’ between nodes/clusters in a network.
Betweenness Centrality for Nursing

- Can show bottlenecks in the knowledge network.
- How strong is a node a gatekeeper for clusters of knowledge.
- Usually non-trivial to detect in bigger networks by other methods.
What is Closeness Centrality?

Nodes with many direct and shortest paths = local centres.

1 / Average distance from each individual to every other individual in the network.

Closeness Centrality for Nursing

- Nodes with many local connections.
- Where are the main knowledge clusters of the network.
- Gives insights into the complexity of the knowledge network.
What is **Eigenvector Centrality**?

How much is an individual a ‘big fish’ in connection to other big fish in the pond.


How well connected is an individual to the parts of the network with the greatest connectivity.

Eigenvector Centrality for Nursing

- Shows important concepts in the network.
- How much is it a “risk” to not know a specific knowledge.
- Can reveal a focus group within the knowledge network.
Wrap-up and Outlook

- Node centrality measures can give additional insights into a knowledge network
  - Provides an additional rational based on the structure and not only on the content
- First experiments* show that there is no easy connection between centrality and performance (needs more experiments)
- Potential: An expert weighted approach to “pre-weight” the network can be interesting to improve the interpretation.

Outlook: Creating a Combined Structure-Based Measure
Thank you for your attention!

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