A Hybrid Model for Drawing Dynamic and Evolving Graphs

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outline

1. Motivation

2. Hybrid model

Who is relevant in network?
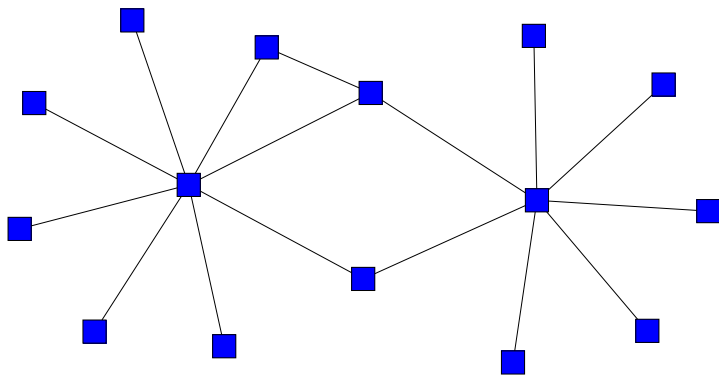
input: 'social' network

- collaboration
  nodes = (human) actors,
  edges = common work
- communication
  nodes = (human) actors,
  edges = communication via
  phone, email, etc.
- citation
  nodes = documents,
  edges = citation/reference

questions:

- impact of a node on the
  network structure
- reason for the importance
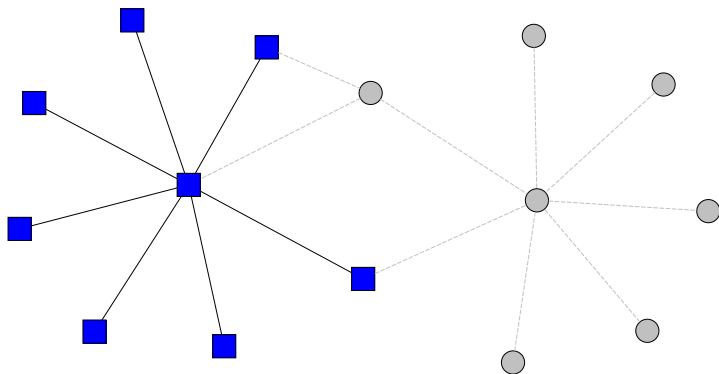- other candidates for similar
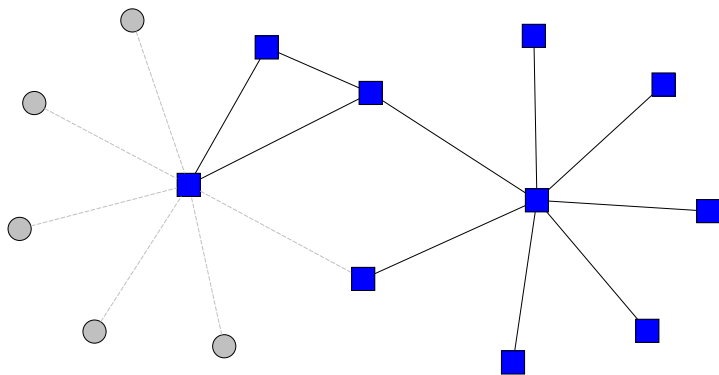 roles

small example

the network

small example

the network at the very beginning

small example

the network after some time

summary

observations:

- time is often an 'implicit' factor
- complete temporal information is rarely available
- measure and their meaning depend on the evolution

conclusions:

- integration of temporal/dynamic data in the analysis
- visualization of dynamic data to emphasize the evolution

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problem formulation

input: sequence of (weighted) graphs

output: visualization, where

- the evolution is emphasized
- esthetic criteria are meet
- preservation of mental map, i.e., identical parts of the graphs should be stable

existing techniques

- *static cumulative view*
  one static layout representing the whole evolution

- *sequential view of each individual graph*
  static layout for individual points in time

- *animations/movies*
  timing/speed of the animation corresponds to evolution
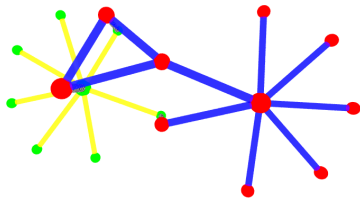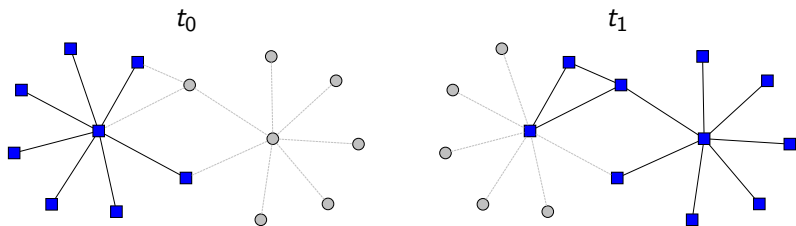
hybrid model

layout requirements:

- 'simultaneous' representation of
  - historic / accumulated information
  - individual points of time

- incorporate external layout requirements
  for example: centralities

idea:

- incrementally calculate a good 2D layout for each snapshot

- place each snapshot in 3D with z-axis equals time

hybrid model

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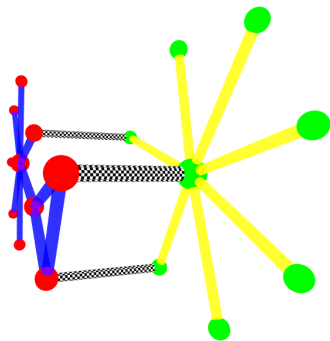 for example: centralities

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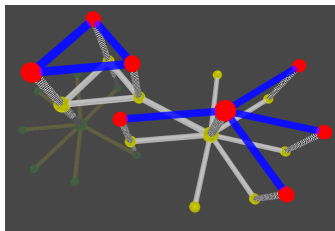
hybrid model for the example

hybrid view
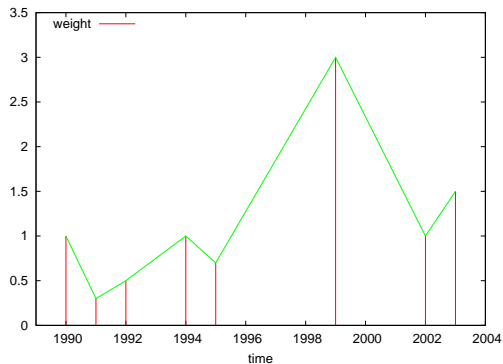
hybrid model for the example

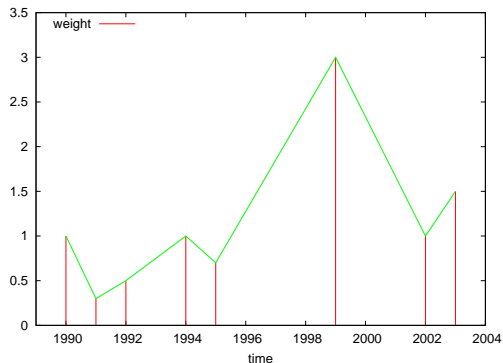*side view:* focus on temporal aspects

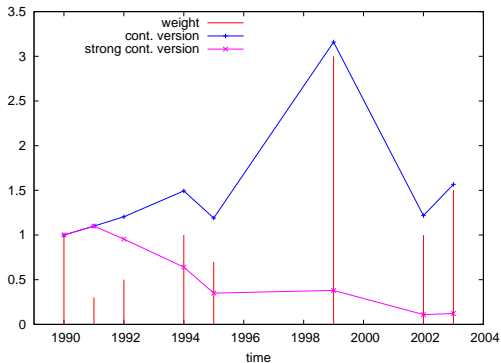*mod. top view:* older parts of the network are partially conceal

weights

- temporal weights fluctuate
- introduction of 'continuous' weights
- different type of continuity

weights

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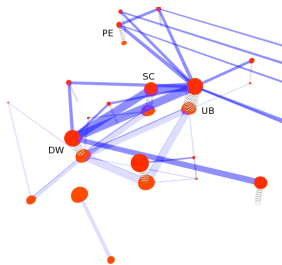- different type of continuity
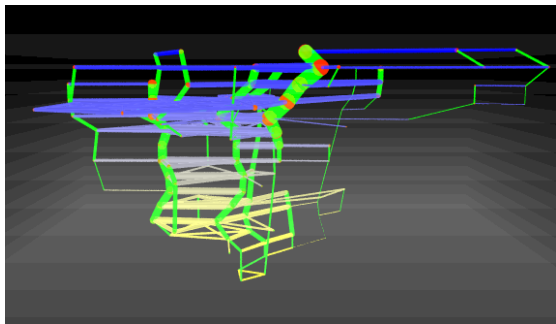
weights

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example: data sets from DBLP

- DBLP = database with computer science publications
- http://www.informatik.uni-trier.de/~ley/db/
- ≈ 630,000 entries
- well maintained !

2 years (top view)

15 years (side view)

conclusion

- visualization of dynamics can highlight many different things
  - 'stable'/frequently occurring parts
  - 'instable'/frequently changing parts
  - individual snapshots
- the hybrid model combines several of these aspects
- user requirements can be integrated

Thanks!

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Thanks!