Network modelling: future directions

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Excuse

Many of us mathematicians are working on networks for its beautiful and interesting theory . . .

Still we should of course every now and then ask ourselves why and how!

My excuse for this presentation: I am not more specialist than anyone else here ...
Applications of networks

Biological populations – social interactions
Computers/sites – electronic communication/links
cells/particles/proteins – bonds/interactions
...

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Knowledge about networks

Two types of network knowledge

a) Some networks are (potentially) completely/globally observed (i.e. digital): web-communities, computer networks, ...

b) Others are only locally observed: social/sexual networks, cell-networks, protein-interaction networks, ...
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Which of these type of networks networks should affect the mathematical treatment!
Common scientific questions:

- Summarize network properties (a)
- Draw conclusion about global network properties (b)
- Study effects of changing network: thinning of edges/nodes, addition of edges/nodes, changing local (or global) characteristics, ...
- Analyse processes taking place ”on” the network: epidemics, spread of information, ...
Extensions

Important extensions

- Static → Dynamic network
- Different type of edges/nodes
- Undirected → directed edges
Potential criticism

Do our network *models* produce the networks we want/think? How can we know?

Some networks are hard to reach. How do we estimate local network properties (unbiased)? RDS?

Many models are based on certain local properties. Which local properties are most "important"? Which models captures global properties best?

Which extensions are most important?