Social Networks & Recommendation Systems

VI. Evolving networks.

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MSc program in Data Science has been developed
as a part of task 10 of the project
„NERW PW. Science - Education - Development - Cooperation”
co-funded by European Union from European Social Fund.

Project

BA network – case study

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Attention!

Excercises 1-8 in total are worth 40% points for the project.

Random connections (A model)

P6.1 Fill the gaps in the following derivation [20%]

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Solution:

Differential equation of the form

$$\frac{dk_i}{dt} = \frac{m}{t},$$

has solution

$$k_i(t) = m \ln\left(\frac{t}{t_i}\right) + m,$$

which leads to

$$\mathcal{P}(k) = \frac{e}{m} e^{-k/m}.$$

Network with fixed size (B model)

P6.2 Fill the gaps in the following derivation [30%]

With the mean-field approach (as far as possible!) determine the degree distribution of the network in which

- The number of vertices is from start constant and equal to N.
- The edges are distributed with preferential attachment rule.

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Following differential equation

$$\frac{dk_i}{dt} = \frac{N-1}{N}\frac{k_i}{2t} + \frac{1}{N},$$

has the solution of the form

$$k_i(t) = \frac{2(N-1)}{N(N-2)}t \approx \frac{2}{N}t,$$

but how to get the distribution from this?

Other projects

P6.3 Check with simulations result obtained for model A. [30%]

P6.4 Check with simulations result obtained for model B. [30%]

P6.5 How to derive distribution in model B? [30%]

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Thank you for your attention!