ERGMs

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March 20, 2019

Outline

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What is ERGMs?

- So far, our measures have described the network at hand.
- Exponential Random Graph Models (ERGMs) are used to describe the local selection forces that shape the global structure of the network.
- ERGMs treats the network at hand as one instance of the universe of networks we could have observed.
- We use ERGMs to find a set of parameters that give us the highest likelihood that we will generate our observed network given the model.

The Model

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- This is basically impossible to calculate.
- Instead, we use use change statistics, which measure the effects of a change of one relationship in the network on the rest of the network.

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ERGMs Walkthrough

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- 2) Create a hypothesis about how ties are formed.
- 3) Identify a configuration from the hypothesis.
- 4) Estimate the model level parameters.

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Example

- Using the Florentine marriage data

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- control.ergm(seed = 1)
  flo.mar.2 = ergm(flomarriage ∼ edges + triangles)
  flo.mar.2
  summary(flo.mar.2)

Example

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Example

Table 1:

	Dependent variable:
	flomarriage
edges	-1.676^{***}
	(0.349)
triangle	0.159
	(0.596)
Akaike Inf. Crit.	112.077
Bayesian Inf. Crit.	117.652
Note:	*p<0.1; **p<0.05; ***p<0.01

Does Wealth Matter?

- flo.mar.4 = ergm(flomarriage $\sim$ edges + nodecov("wealth"))
  flo.mar.4
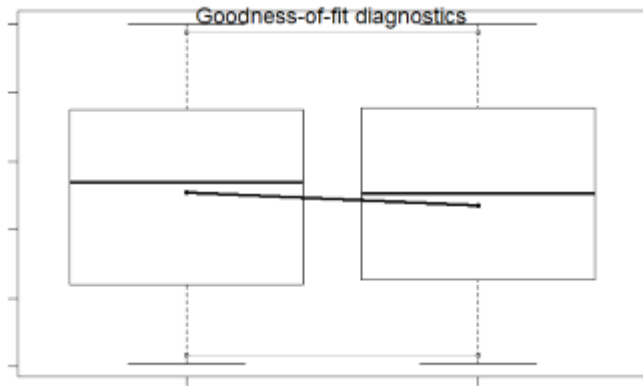 summary(flo.mar.4)

Does Wealth Matter?

Table 2:

	Dependent variable:
	flomarriage
edges	-2.595^{***}
	(0.536)
nodecov.wealth	0.011^{**}
	(0.005)
Akaike Inf. Crit.	107.109
Bayesian Inf. Crit.	112.684
Note:	*p<0.1; **p<0.05; ***p<0.01

Goodness of Fit

- control.gof.ergm(nsim = 20)
  flo.mar.4.gof2 = gof(flo.mar.4 ∼ distance)
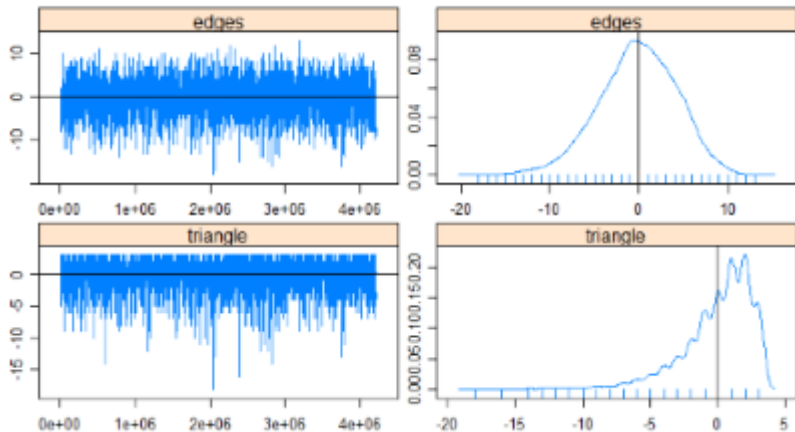 summary(flo.mar.4.gof2)
  plot(flo.mar.4.gof2)

Goodness of Fit

Goodness-of-fit diagnostics

Goodness of Fit

- mcmc.diagnostics(flo.mar.2)

Goodness of Fit

Outline

1. Intro to ERGMs

2. ERGM Steps

3. Example

4. Conclusion

Conclusion

- ERGMs is hard.
- Treating ties as random variables?
- Is the observed network the best sample?
- Applications for political science