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Fitting the directed $\mathbb{S}^1$ model to real networks

Inputs from a real network :

1. joint degree distribution $P(k^{\mathrm{in}}, k^{\mathrm{out}})$
2. reciprocity r
3. density of triangles

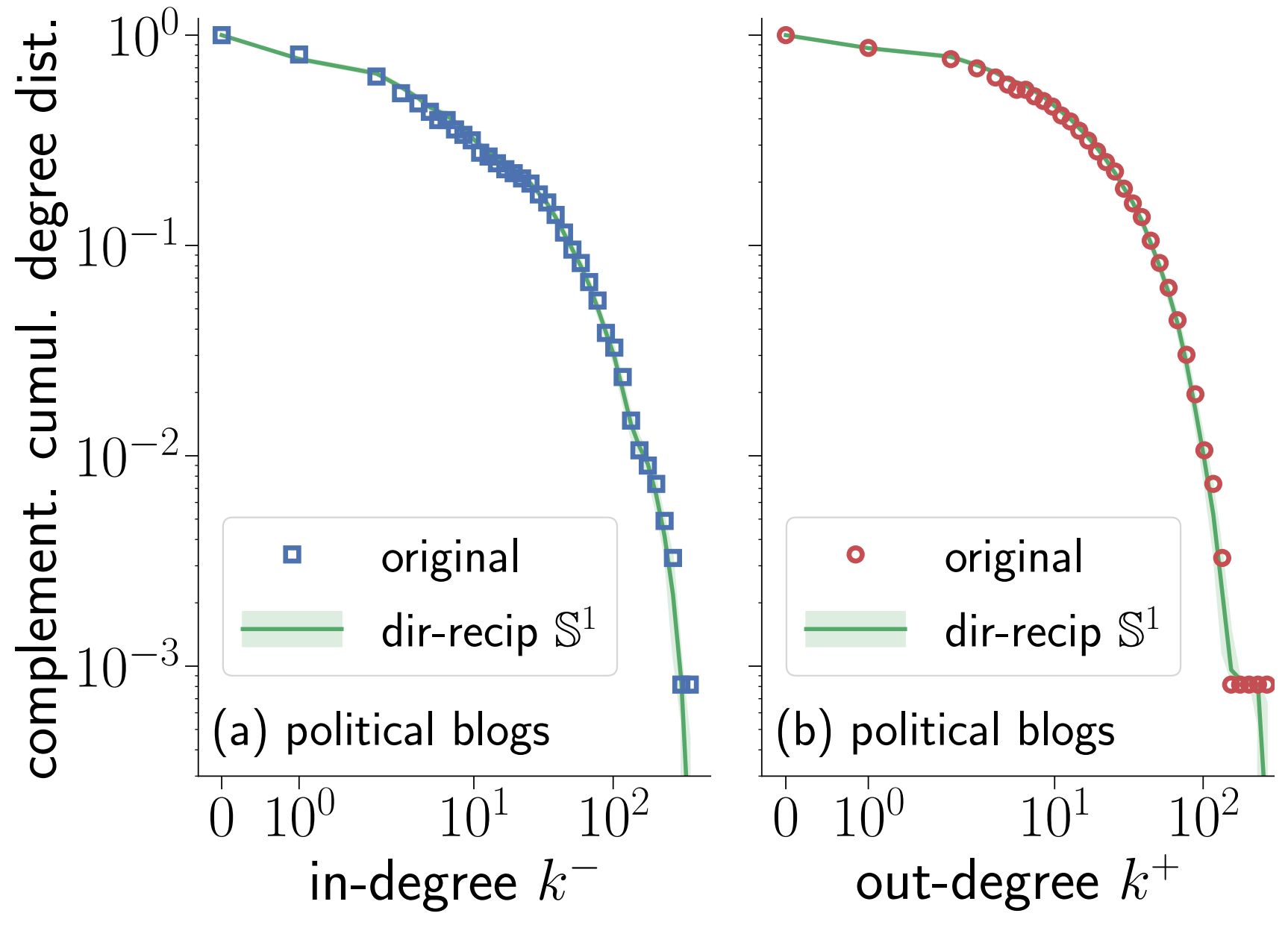
Assuming uniform angular positions for nodes,

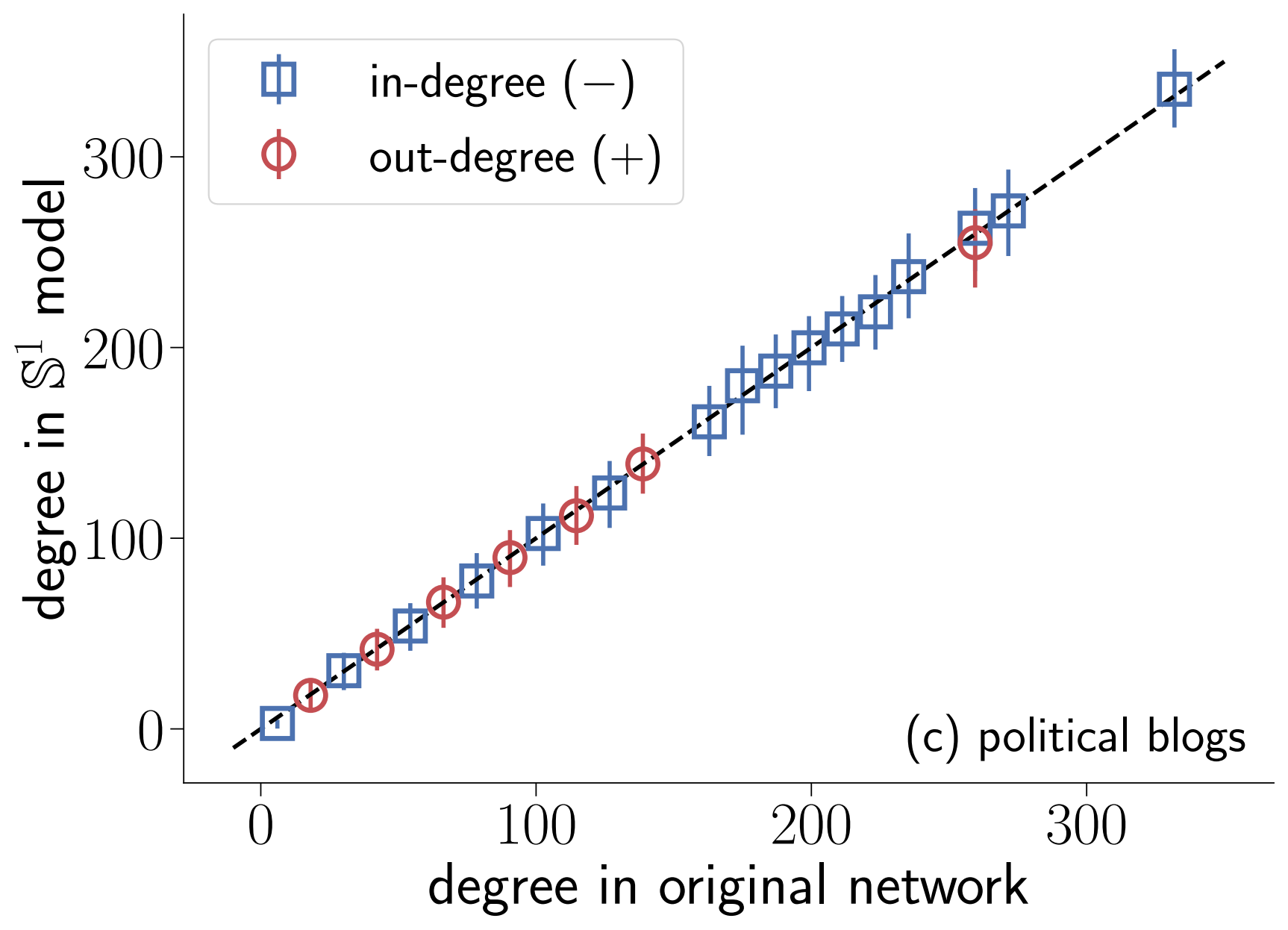
1. infer $(\kappa^{\mathrm{in}}, \kappa^{\mathrm{out}})$ to replicate $P(k^{\mathrm{in}}, k^{\mathrm{out}})$ on average (analytical)
2. set ν to reproduce r (analytical)
3. adjust β to recreate the density of triangles (semi-analytical)

Generate a sample of random directed networks :

1. assign angular positions randomly
2. draw directed links using the probabilities defined by the framework for deliberate reciprocity

Inference algorithm adapted from New J. Phys. 21, 123033 (2019).


complement. cumul. degree dist.
10^0
10^{-1}
10^{-2}
10^{-3}
original
dir-recip $\mathbb{S}^1$
(a) political blogs
0
10^0
10^1
10^2
in-degree k^-
original
dir-recip $\mathbb{S}^1$
(b) political blogs
0
10^0
10^1
10^2
out-degree k^+


in-degree (−)
out-degree (+)
degree in $\mathbb{S}^1$ model
0
100
200
300
0
100
200
300
degree in original network
(c) political blogs

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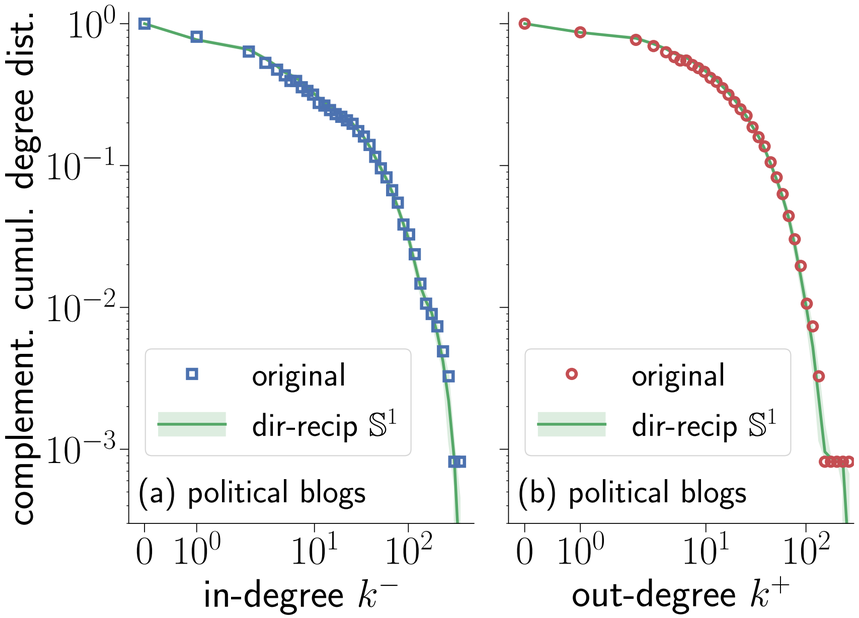

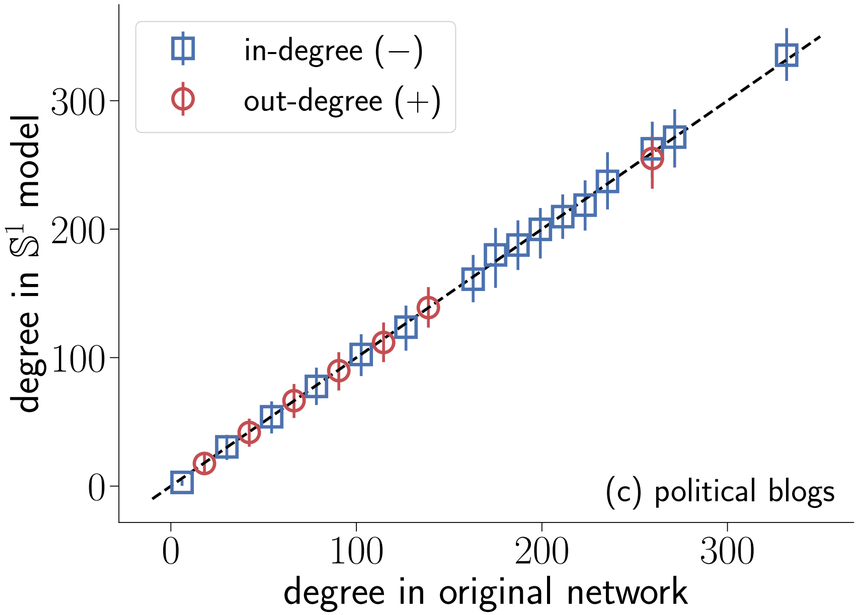

Inference algorithm adapted from New J. Phys. 21, 123033 (2019).

Realistic clustering patterns in directed geometric networks