Who's Who in the Network. Wanted: Key Player

郭宇杰†, Yu-Chieh Kuo[2]

[1]Department of Information Management, National Taiwan University
[2]Department of Electronic Engineering, National Taiwan University

December 15, 2022

Motivation

- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.
- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.
- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.
- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.

Literature Review

Outline

Nash-Bonacich Equilibrium

Theorem 1

Let $\mu_1(\boldsymbol{G})$ be the largest eigenvalue of $\boldsymbol{G}$, the matrix $\beta[\boldsymbol{I} - \lambda^* \boldsymbol{G}]$ is well-defined and nonnegative if and only if $\beta > \lambda\mu_1(\boldsymbol{G})$, thus the unique interior Nash equilibrium is given by $\boldsymbol{x}^*(\boldsymbol{\Sigma}) = \frac{\alpha}{\beta+\gamma b(\mathcal{G},\lambda^*)} b(\mathcal{G}, \lambda^*)$.

- Given the unique Nash equilibrium $\boldsymbol{x}^*(\boldsymbol{\Sigma}) = \frac{\alpha}{\beta+\gamma b(\mathcal{G},\lambda^*)} b(\mathcal{G}, \lambda^*)$, we want to analyze how three different effects influence the equilibrium.
  - There exists no equilibrium if the matrix of cross-effects $\boldsymbol{\Sigma}$ reduces to $\lambda \boldsymbol{G}$.
  - There is a unique equilirium if $\boldsymbol{\Sigma}$ reduces to $-\beta \boldsymbol{I} - \gamma \boldsymbol{U}$.

Model

Proposition 1

Let $\mu_1(\boldsymbol{G})$ be the largest eigenvalue of $\boldsymbol{G}$, [1] *the matrix $\beta[\boldsymbol{I} - \lambda^* \boldsymbol{G}]$ is well-defined and nonnegative if and only if $\beta > \lambda \mu_1(\boldsymbol{G})$, thus the unique interior Nash equilibrium is given by $\boldsymbol{x}^*(\boldsymbol{\Sigma}) = \frac{\alpha}{\beta + \gamma b(\mathcal{G}, \lambda^*)} b(\mathcal{G}, \lambda^*)$.*

- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.
- As a decision-maker or policymaker, we may want to find the most influential player in the network to break or strengthen such effect.

[1] $\mu_1(\boldsymbol{G})$ is well-define and larger than 0 since all eigenvalues of a symmetric matrix $\boldsymbol{G}$ are real, and the diagnal of $\boldsymbol{G}$ is zero.

1. Model Settings

2. Section no. 2

Symbol test

- Let $\Game, \mathit{\Gamma}$, we have
$$1 + \alpha + q + g(x) = 0.$$