# Learning to Infer Structures of Network Games

Emanuele Rossi, Federico Monti, Yan Leng, Michael Bronstein, Xiaowen Dong

Network Games

Modeling strategic interactions between entities
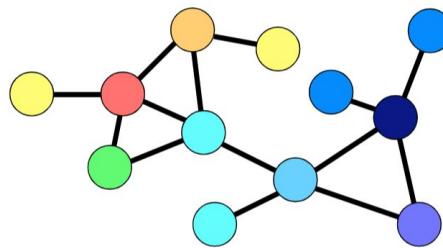

Time spent on a social app
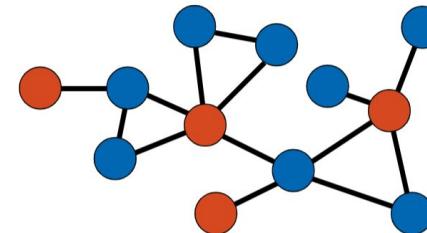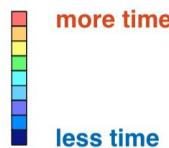
Buying a book
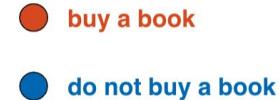
Problem Setup

Learning the network structure from the players' actions

Predict

more time

less time

Players' Actions
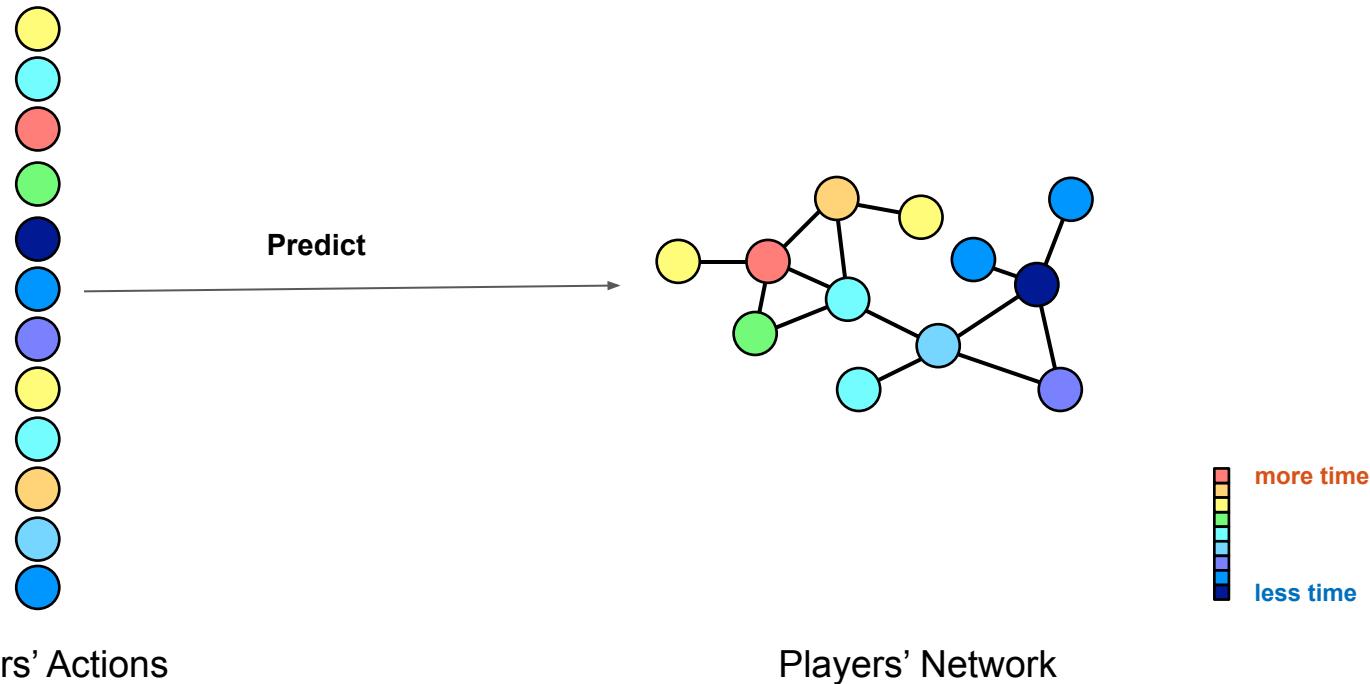
Players' Network

Different Types of Network Games

The type of utility function determines the actions players will take
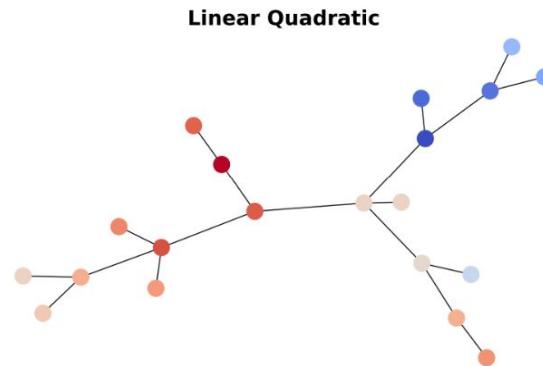
$$\mathbf{x}^* = \left(\mathbf{I} - \beta\mathbf{A}\right)^{-1}\mathbf{b} \qquad \mathbf{x}^* = \mathbf{A}^{-1}\mathbf{b} \qquad \mathbf{x}^* = \mathbf{A}\mathbf{x}^*$$
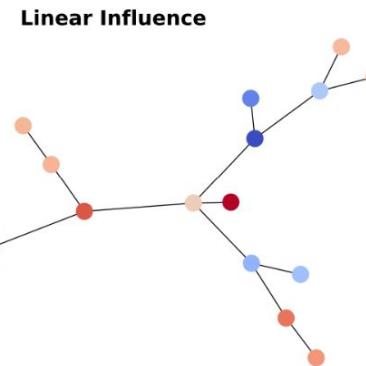
$$\mathbf{x}^* = \mathcal{F}(\mathbf{A})\mathcal{H}(\mathbf{b})$$
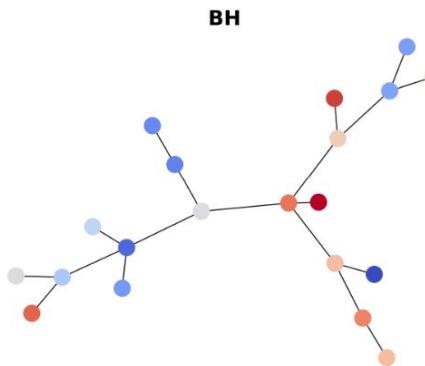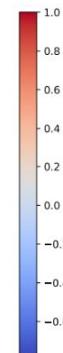
Our Approach

A Transformer-like Architecture

Games

Players

Transformer-like Encoder

Hidden Dim

Dot-Product Decoder

Players

Players

Players Actions

Encoding

Adjacency Matrix
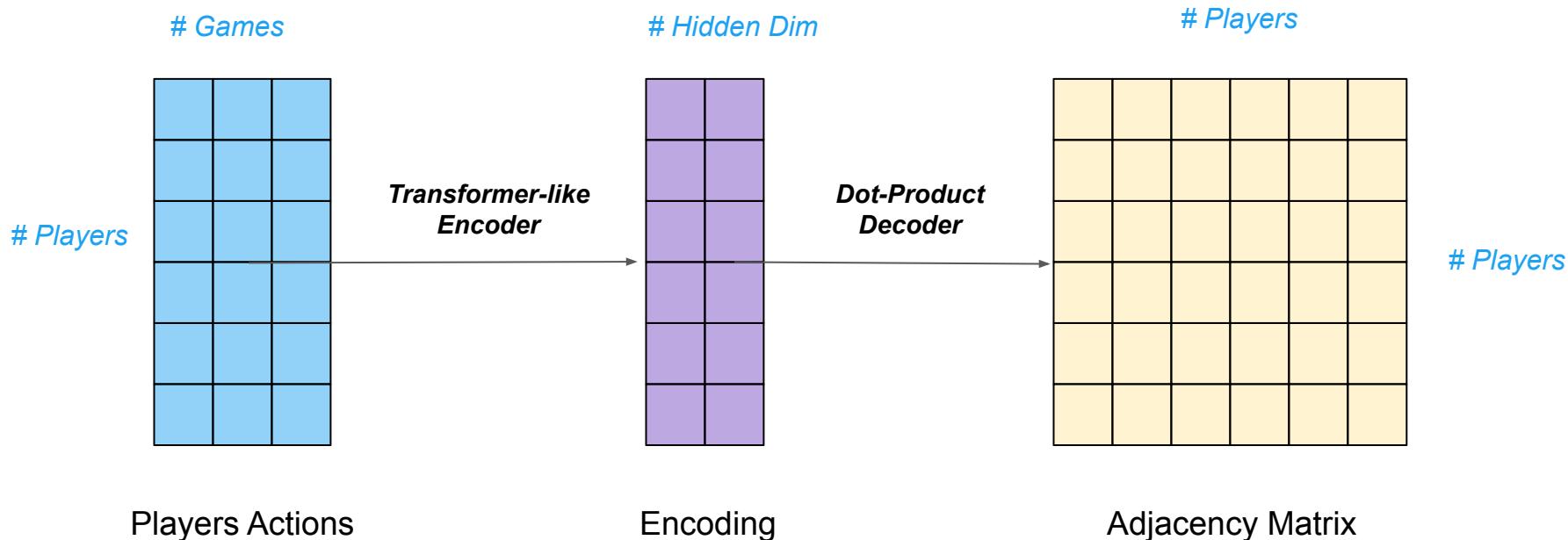
Experimental Results

Model	Indian Villages	Yelp Ratings
Correlation	0.5816 ± 0.0135	0.6222 ± 0.0043
Anticorrelation	0.4184 ± 0.0135	0.3778 ± 0.0043
Graphical Lasso	0.5823 ± 0.0152	0.6523 ± 0.0038
Baraki and Honorio	0.5715 ± 0.0164	0.6786 ± 0.0032
LinQuadOpt (indep.)	0.5557 ± 0.0108	0.6796 ± 0.0033
LinQuadOpt (homop.)	0.5789 ± 0.0174	0.6310 ± 0.0036
DeepGraph	0.4965 ± 0.0143	0.6776 ± 0.0039
NuGgeT	$\mathbf{0.6324}\pm0.0167$	$\mathbf{0.7057}\pm0.0035$