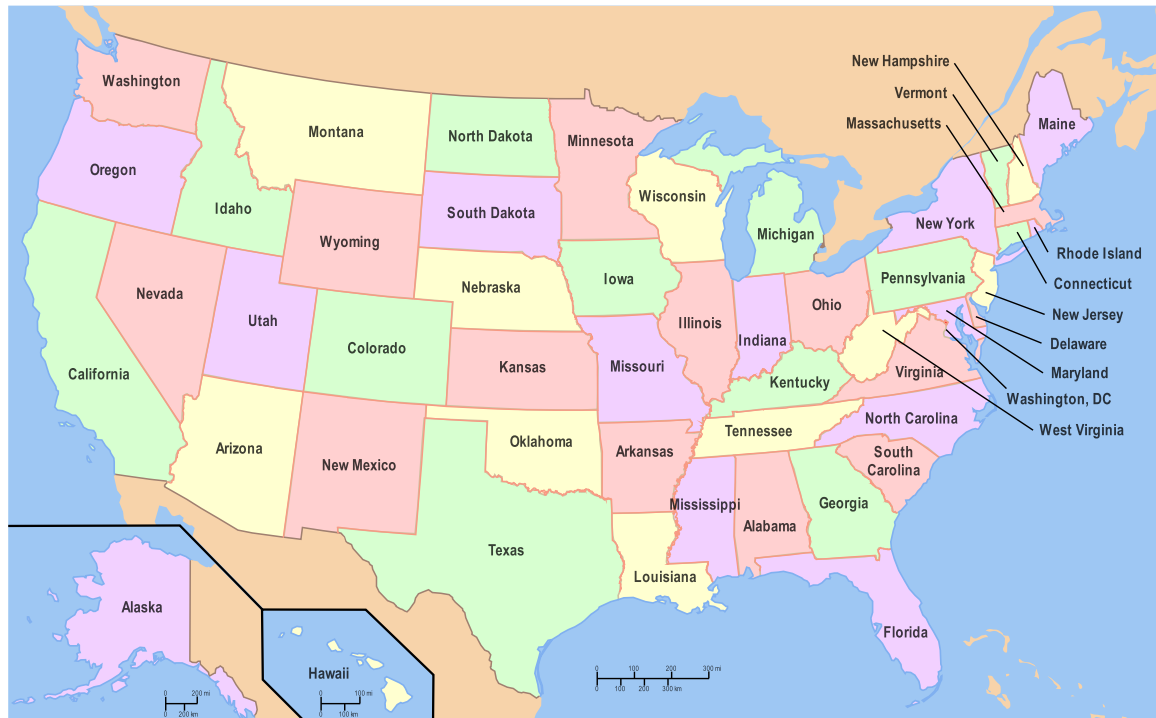# Graph-Relational Domain Adaptation

Zihao Xu, Hao He, Guang-He Lee,
Yuyang Wang, Hao Wang
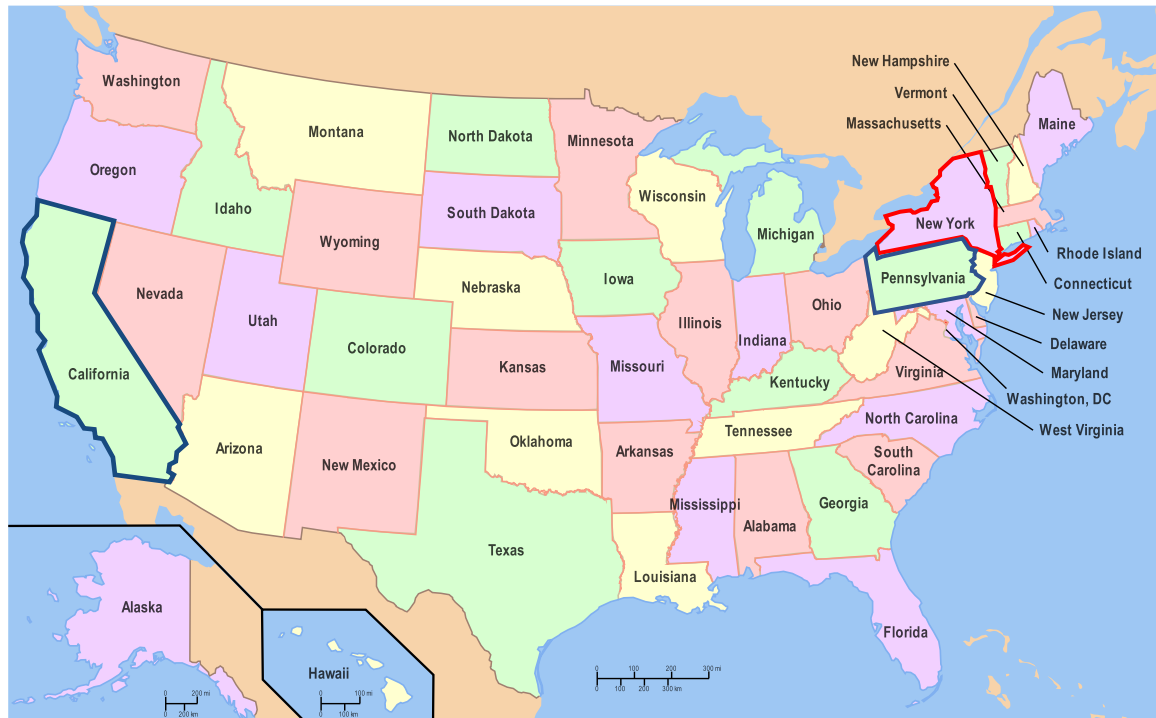
# Domains are not equal
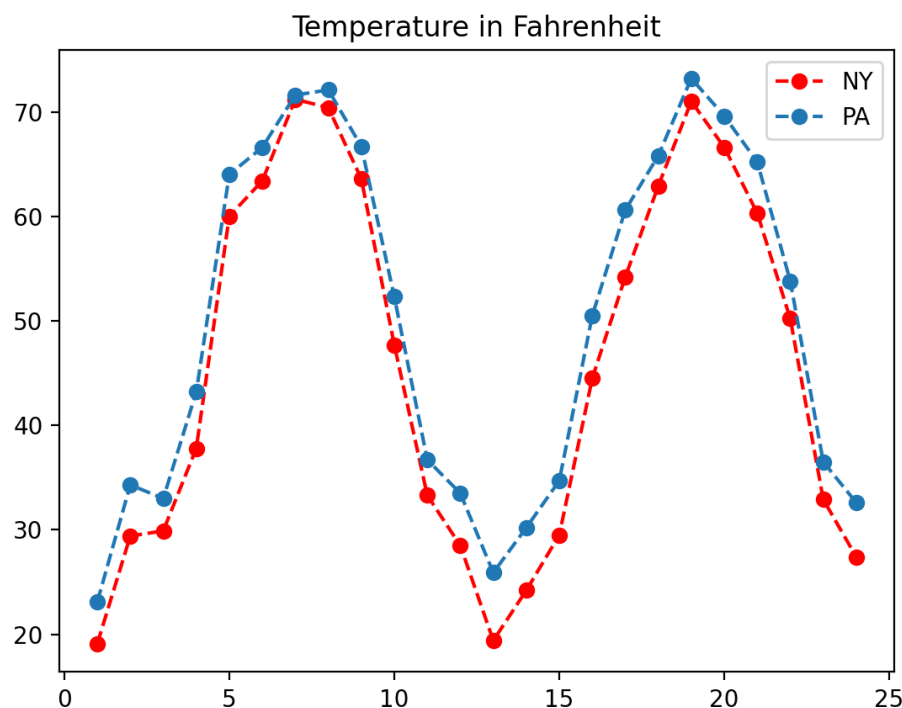


Transfer weather prediction model
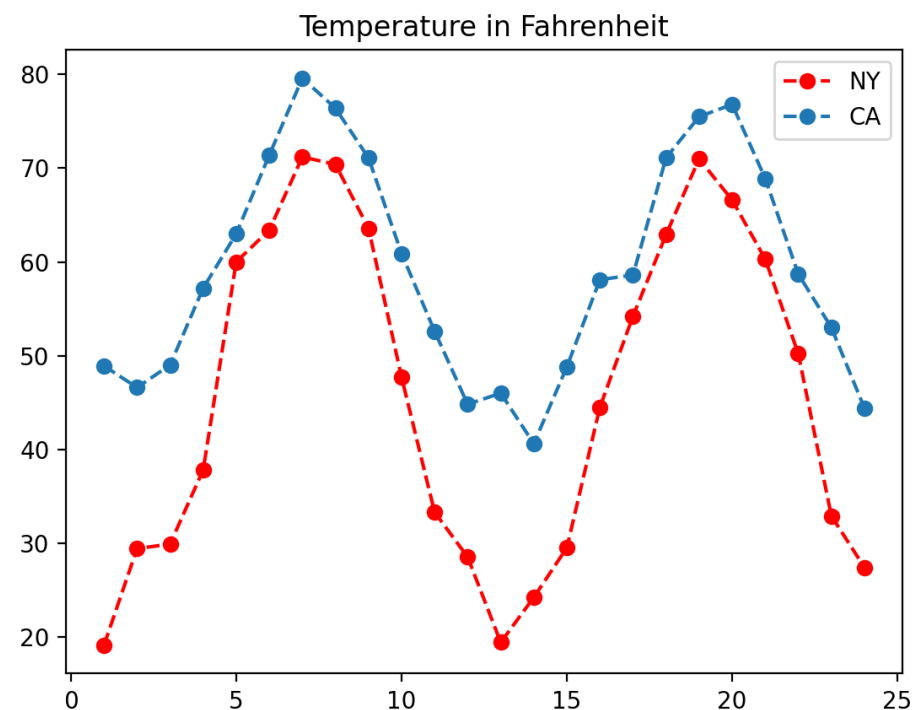Other states → NY

## Domains are not equal



Influence
PA → NY?
CA → NY?

## Domains are not equal



Temperature in Fahrenheit

PA & NY

Influence
PA → NY?
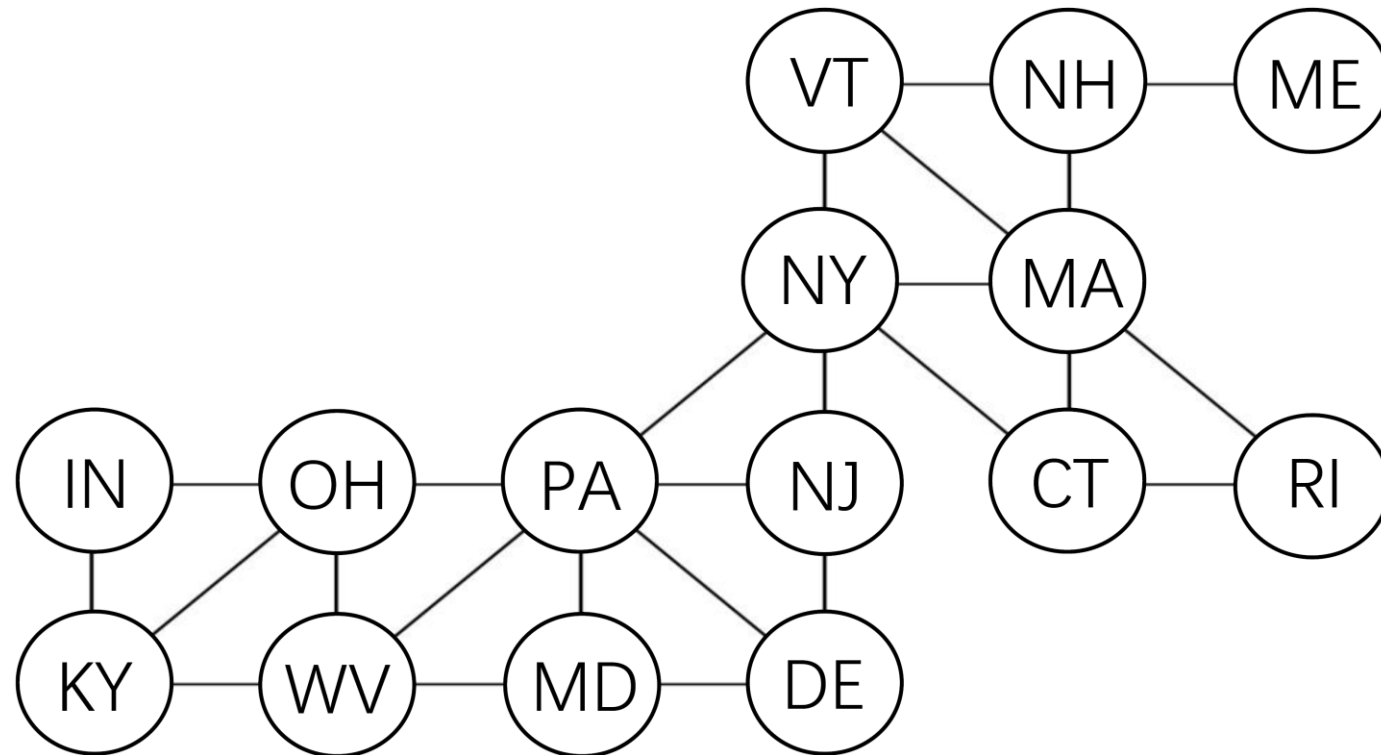CA → NY?

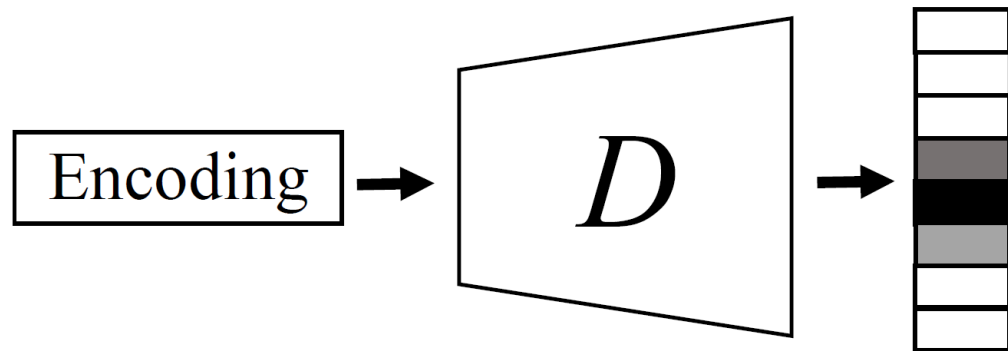Temperature in Fahrenheit

CA & NY

# Domains are not equal
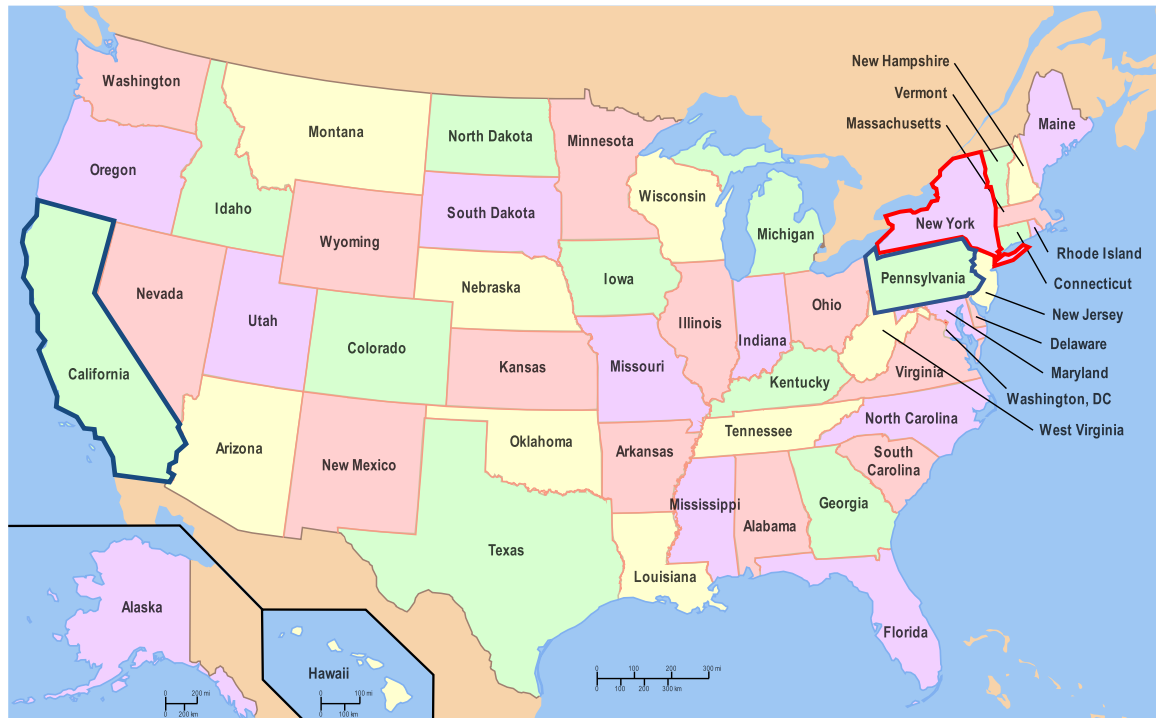


Influence
PA → NY?
CA → NY?

*Heterogeneous!*

Use graph to model Heterogeneity

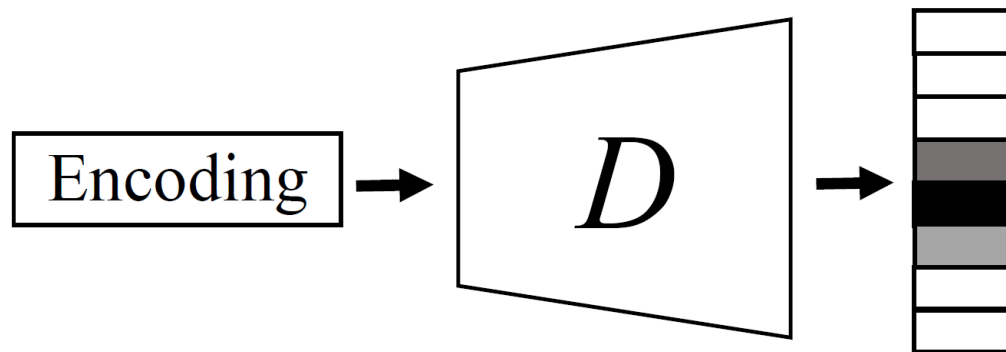# Novel Graph Discriminator



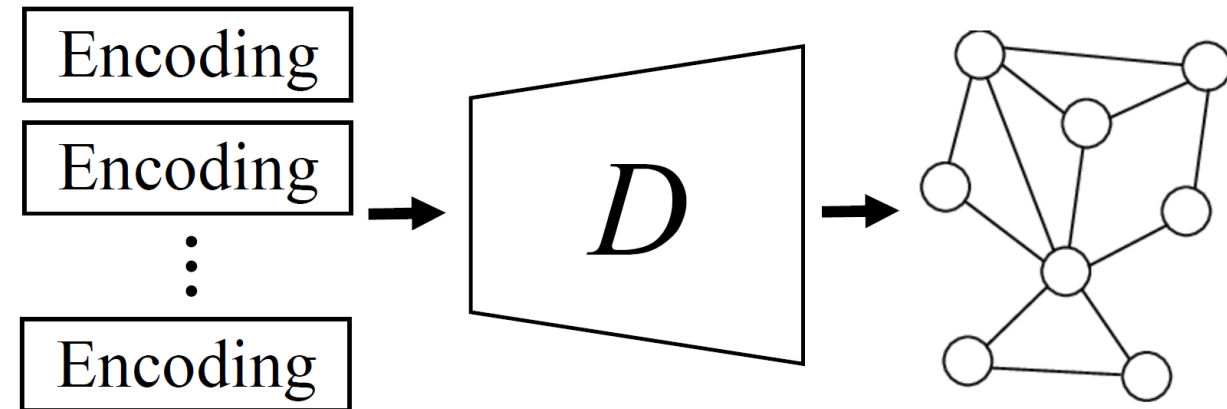Classifying the Domain Index
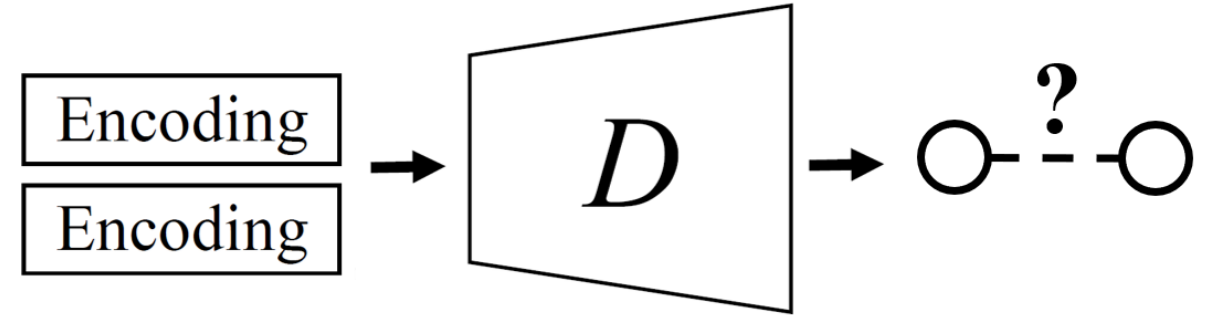
Discriminating the domain connection

Traditional DA method

Ours

## Novel Graph Discriminator



Classifying the Domain Index

Reconstructing the Domain Graph

Traditional DA method

Ours

## Model Structure



Data **X**

Adjacency
matrix **A**

$E$ → e → $F$ → Prediction $y'$

$D$ → Domain
Graph
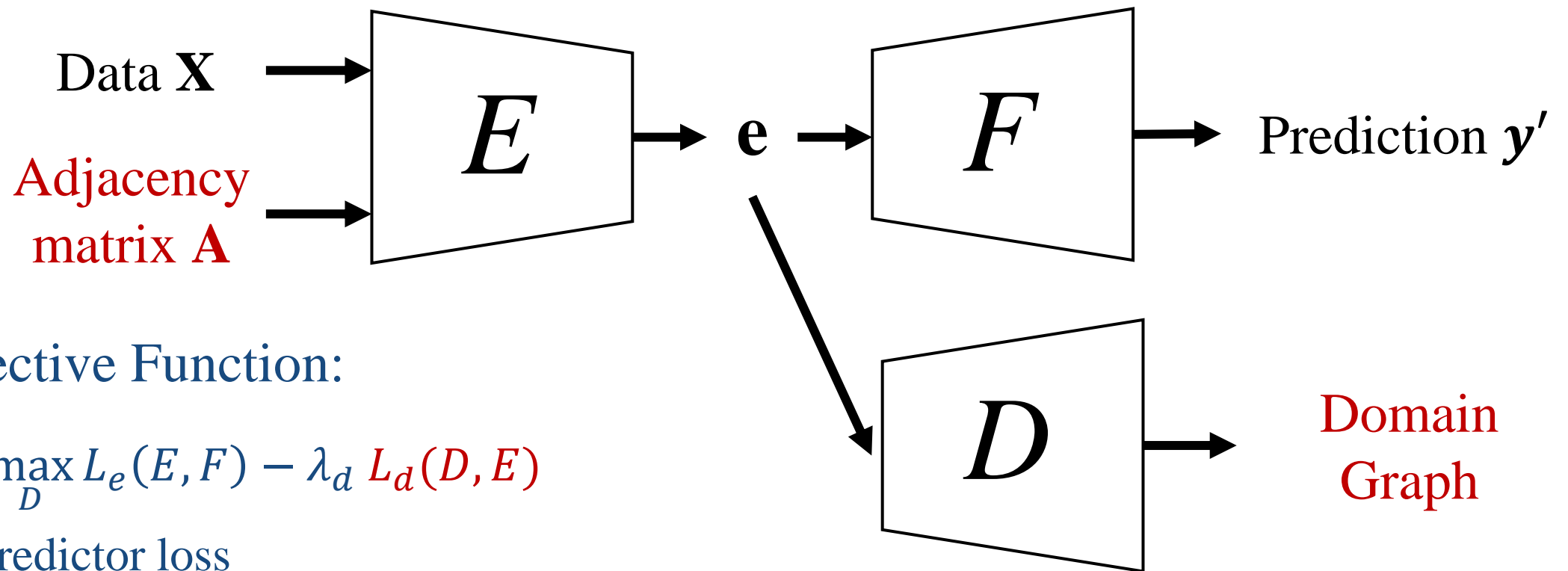
Objective Function:

$$\min_{E,F} \max_{D} L_e(E,F) - \lambda_d \, L_d(D,E)$$

$L_e$: predictor loss

$L_d$: graph discriminator loss

## Theory (informal)

- Traditional method is equivalent to using our method with a fully-connect graph (clique).

- D and E converges if and only if $E_{i,j}[A_{i,j}|e_i, e_j] = E_{i,j}[A_{i,j}]$.

- The global optimal of the two-player game between E and D matches 3 player game E, D, F.
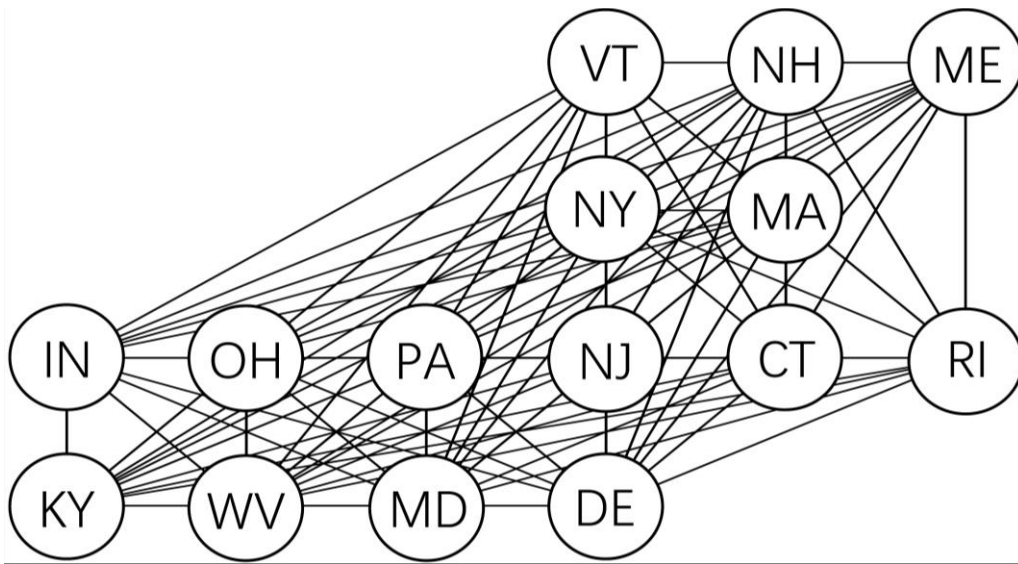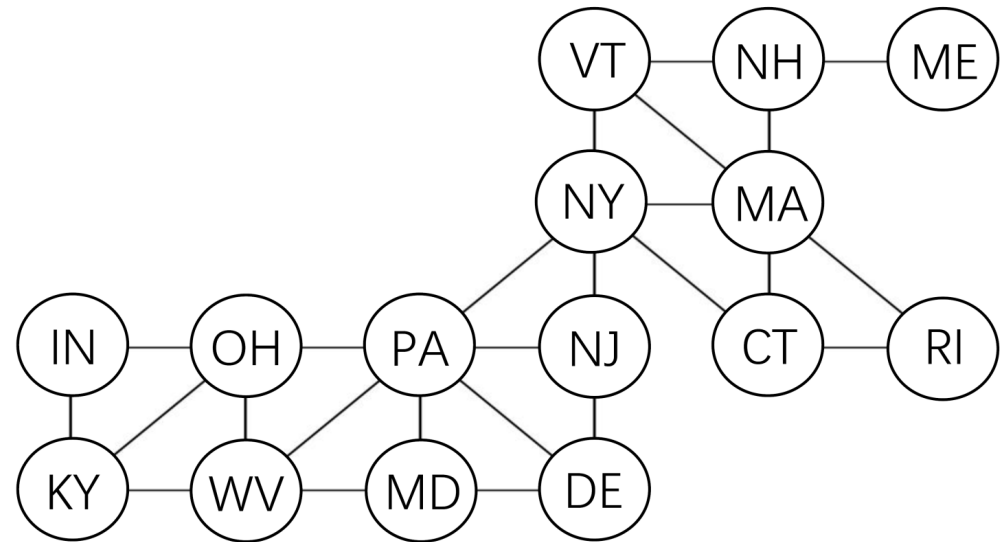
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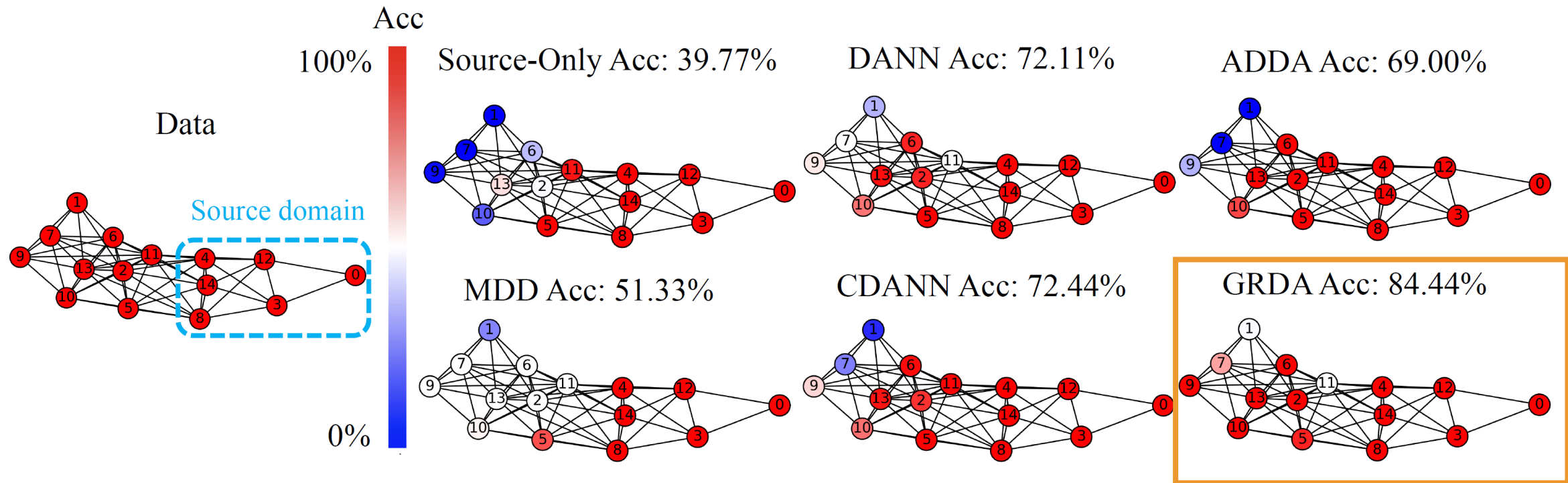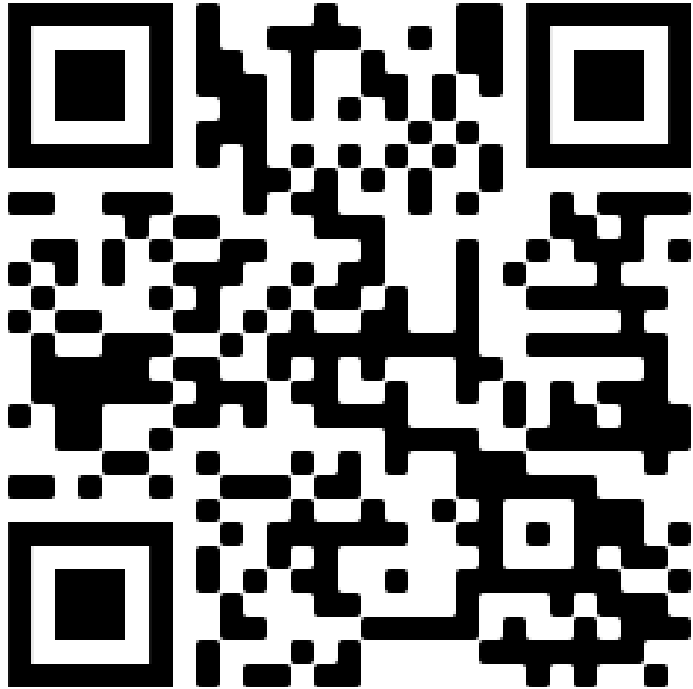
Take advantage of Heterogeneity



Traditional DA method
(Equivalent)

Ours

## Experiment on DG-15

Code

https://github.com/Wang-ML-Lab/GRDA



Paper

https://arxiv.org/abs/2202.03628

# Thank you!
# Q & A