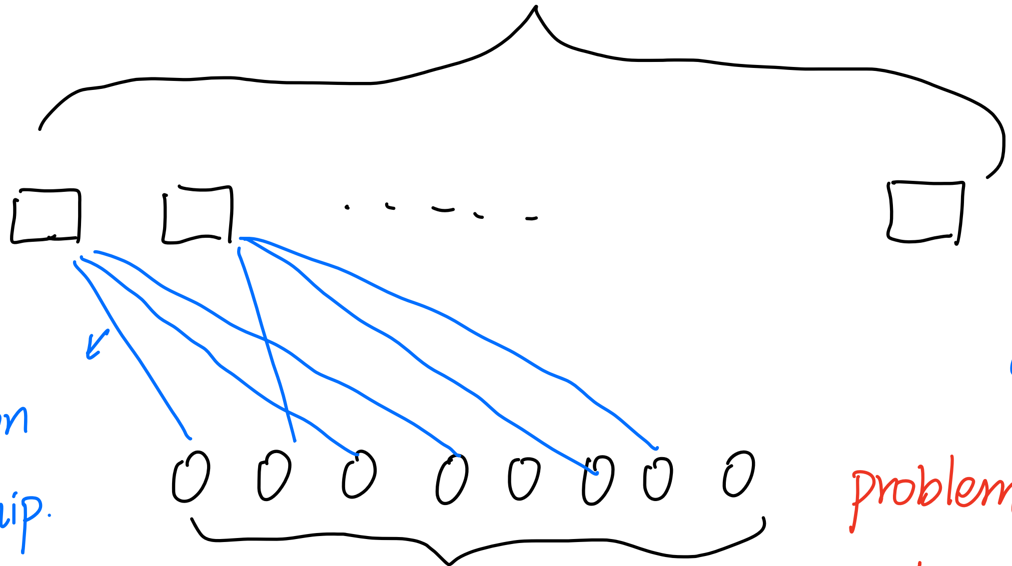
Bipartite Graph

15-20 posters



degree = 3

degree = 3, 4, 5, 6

Evaluation Relationship.

8 judgers.

problem:

Judgers tend to have different scoring habit.

14 Questions

... 1-5 1-5	group 1		group 2
... 1-5	group 3		group 4

Judgement Matrix X (for each Question).

X =

judgers \ Posters	1	2	...				15.
1	3	0	4	2	. - -	..	0.
2	2		3				
3							
4							
5							
6							
7							
8							

predictive

Translation property

Sparse Matrix

Z- score Normalization

$$z = \frac{(X - mean)}{standard\ deviation}$$

$\rightarrow \mu_1, \sigma_1 \rightarrow z_1 = \begin{pmatrix} z_{11} \\ z_{12} \\ \vdots \\ z_{1,15} \end{pmatrix}^T$

$\rightarrow \mu_2, \sigma_2 \rightarrow z_2$

$\rightarrow \mu_3, \sigma_3 \rightarrow z_3$

$\vdots$

$\rightarrow \mu_8, \sigma_8 \rightarrow z_8$

$\Rightarrow$

$$Z = \begin{bmatrix} z_1 \\ z_2 \\ \vdots \\ z_8 \end{bmatrix} = \begin{array}{c} \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1\,15} \\ \vdots & & & \\ z_{81} & z_{82} & \cdots & z_{8\,15} \end{bmatrix}_{8\times 15} \\ \begin{array}{cccc} \bar{z}_1 & \bar{z}_2 & \quad & \bar{z}_{15} \end{array} \end{array}$$

Normalized Judgement Matrix

$$\mu_i = \frac{\sum_j x_{ij}}{n_i} \qquad \sigma_i = \sqrt{\frac{\sum_j (x_{ij} - \mu_i)^2}{n_i}}$$

n_i: # of non-zero element in ith row

$$z_{ij} = \begin{cases} \dfrac{x_{ij} - \mu_i}{\sigma_i} & \text{if } x_{ij} \neq 0 \\ 0 & \text{if } x_{ij} = 0 \end{cases}$$

Re-scaling Normalized Scores → Make scores lies in range [0,5].

Mix-Max Scaling

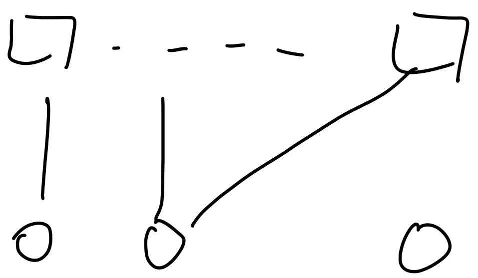
$$\text{New Score} = 1 + 4 \times \frac{\text{Normalized Score} - \text{Min Normalized Score}}{\text{Max Normalized Score} - \text{Min Normalized Score}}$$

Inherently Bias in Nature

Cannot find a normalizing technique that make these judgements absolutely fair (achieve max fairness through modeling)

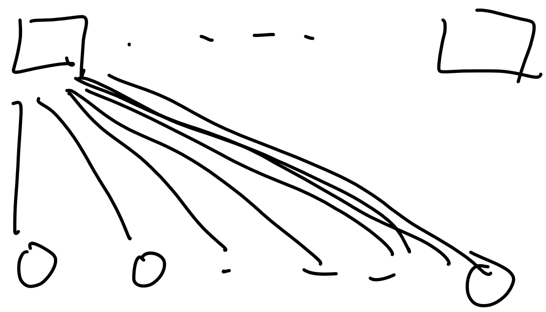
Consider extreme cases: (Number of judgers for each poster)

① 1



No way to compare poster quality

② 8



Do not need to do anything

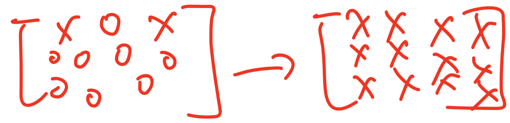
3 is somewhere in between

Sensitivity Issue

Sample size is two small. Any flutuation of a single data point may greatly impact the result.

Still have problem: Although judgers are randomly assigned to several posters.

One may be assigned to posters that are all have high quality



Any way to make imputation? sparse matrix → full-value matrix

predict the unknown scores?

Hypothesis Testing: The scoring habits of judgers are statistically significant?

Mixed Effect Model

$$y_{ij} = \beta_0 + a_i + b_j + \varepsilon_{ij}$$

y_{ij}: score_{ij}

β_0: overall average score

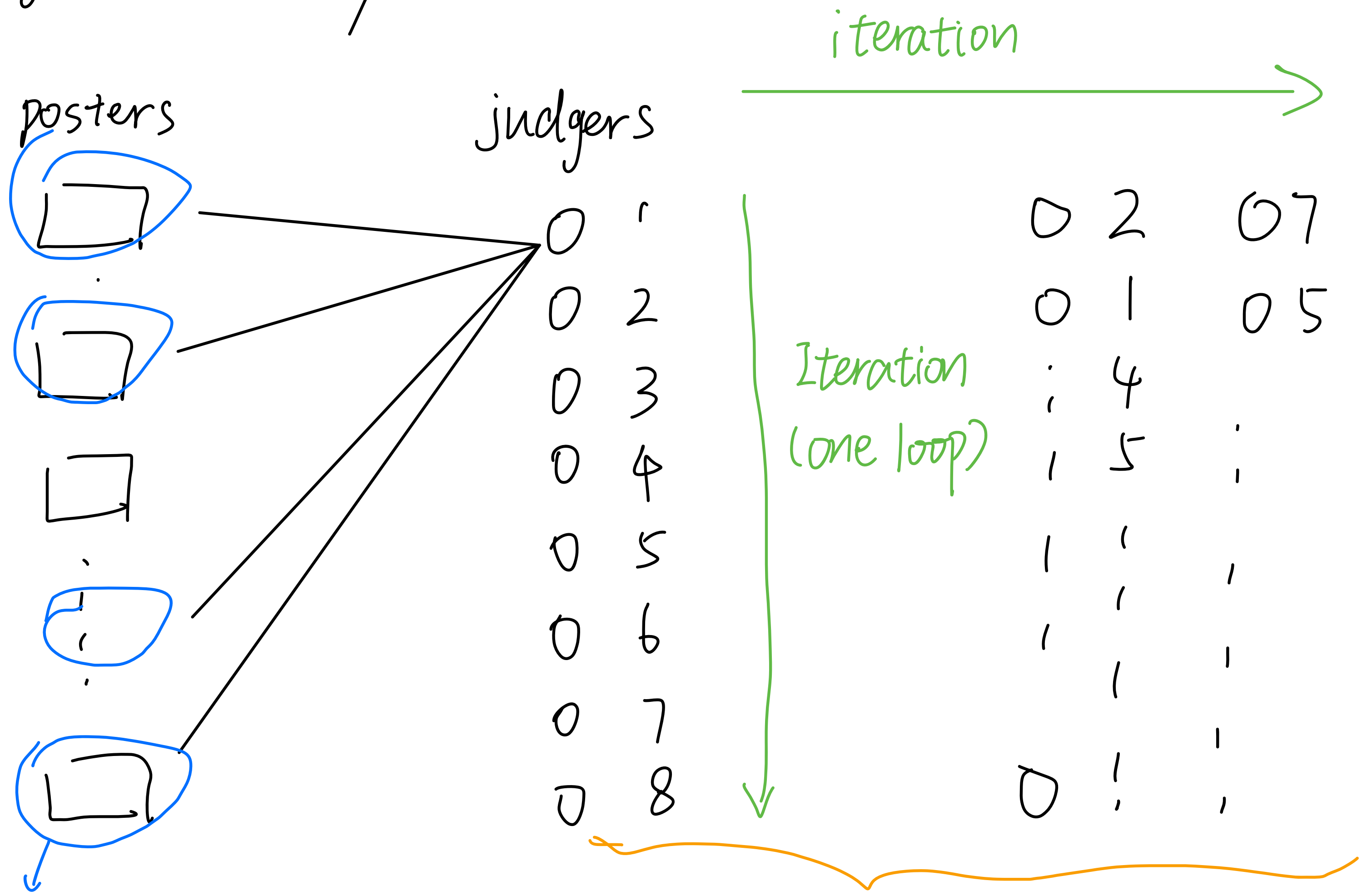
a_i: random effect for judgers

b_j: random effect for posters

ε_{ij} → error residual (variance that are not explained by judgers and posters)

Point estimate ⇒ Confidence Interval Estimate

Algorithm Way



Reorder the position of posters for each iteration

Different permutation of judgers.