

# Collaborative Filtering

*based on user similarity*

*Zhe Xie, Kugelmann Stephan,  
Massé Benoit, Freitag Francois*

# Task

**Several** users already rated an item

One user haven't rated it yet

→ Will he like it ?

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**Goal** : Predict his rating for this item

**How** : Similarity between users

# Main issue

How to measure the similarity?

Efficiency of the algorithm ?


# Algorithm

message #	Ken	Lee	Meg	Nan
1	1	4	2	2
2	5	2	4	4
3			3	
4	2	5		5
5	4	1		1
6	?	2	5	?

Figure 5: a sample matrix of ratings.

*Step 1: Sample matrix*

# Algorithm



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Figure 5: a sample matrix of ratings.

Step 1: Sample matrix

$$\begin{aligned}
 r_{KL} &= \frac{\text{Cov}(K, L)}{\sigma_K \sigma_L} \\
 &= \frac{\sum_i (K_i - \bar{K})(L_i - \bar{L})}{\sqrt{\sum_i (K_i - \bar{K})^2} \sqrt{\sum_i (L_i - \bar{L})^2}} \\
 &= \frac{-2 - 2 - 2 - 2}{\sqrt{10} \sqrt{10}} = -0.8
 \end{aligned}$$

Step 2: Define the normalized covariance matrix

# Algorithm

↓

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Figure 5: a sample matrix of ratings.

Step 1: Sample matrix

	Ken	Lee	Meg	Nan
Ken	1	-0.8	1	0
Lee	-0.8	1	-1	0.6
Meg	1	-1	1	1
Nan	0	0.6	1	1

Covariance matrix

$$\begin{aligned}
 r_{KL} &= \frac{\text{Cov}(K, L)}{\sigma_K \sigma_L} \\
 &= \frac{\sum_i (K_i - \bar{K})(L_i - \bar{L})}{\sqrt{\sum_i (K_i - \bar{K})^2} \sqrt{\sum_i (L_i - \bar{L})^2}} \\
 &= \frac{-2 - 2 - 2 - 2}{\sqrt{10} \sqrt{10}} = -0.8
 \end{aligned}$$

Step 2: Define the normalized covariance matrix

$$\begin{aligned}
 K_{6\text{pred}} &= \bar{K} + \frac{\sum_j (J_6 - \bar{J}) r_{KJ}}{\sum_j |r_{KJ}|} = \\
 &= 3 + \frac{2r_{KM} - r_{KL}}{|r_{KM}| + |r_{KL}|} = 3 + \frac{2 - (-.8)}{|1| + |- .8|} = 4.56
 \end{aligned}$$

Step 3: Define the rating based on the others users weighted rating

# Introduction to the dataset

## Dataset: MovieLens data set

collected by the GroupLens Research Project at the University of Minnesota

<http://grouplens.org/node/73>

User	Movie	Grade
1	1	4
2	1	1
3	2	5

*Extraction from the dataset*

943 users

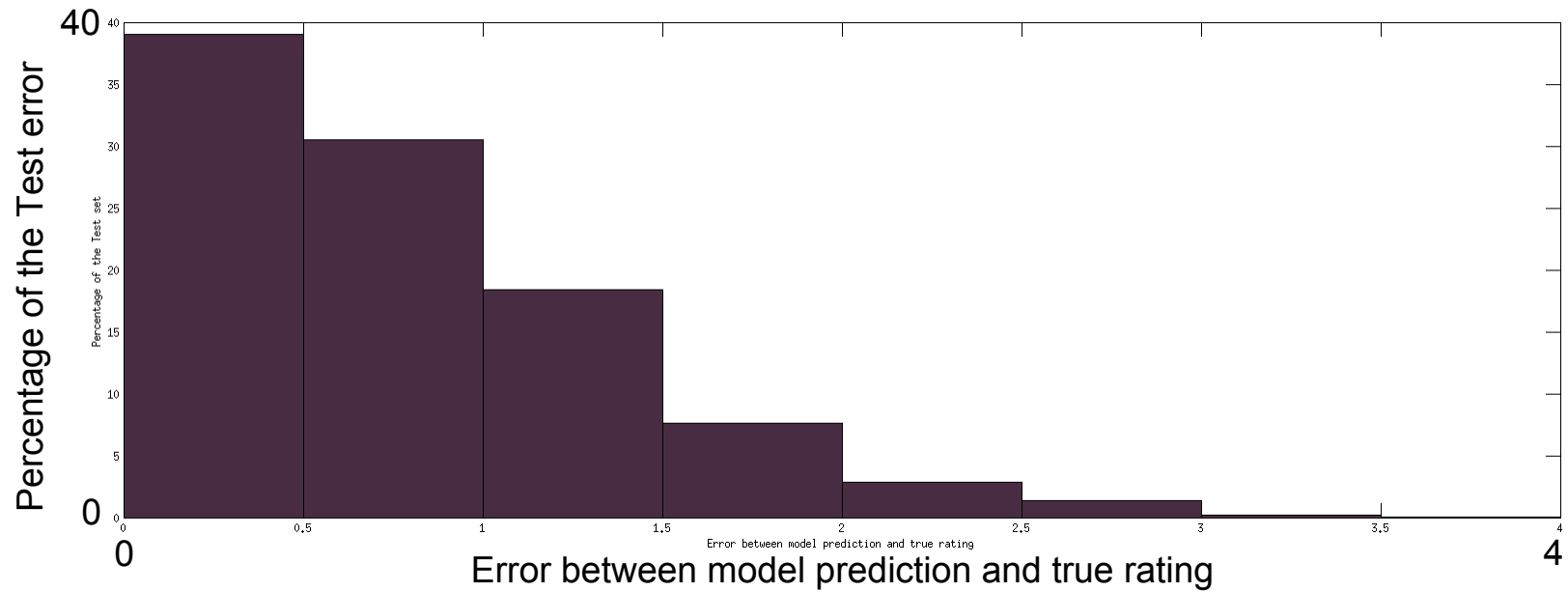
1682 movies

Grades from 1 to 5

100 000 ratings



# Histogram



# Questions