

Master Thesis  
Recommender Systems Comparison

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# Part I

## Master Thesis

### 1 Intro

This is the intro suction for this master thesis. Why we need recommendation systems? Retailers can propose the right product to the right target group. User get advertisements the may be interested in.[2]

History, what has been tried so far?

### 2 Collaborative filtering

What is collaborative filtering. [2]

#### 2.1 Content based

$$w = R^{-1}M^T \tag{1}$$

Normalized

$$w = (\lambda I + R^T R)^{-1} R^T M \tag{2}$$

#### 2.2 Latent Factors

test sadsad  
sad  
asd  
ds

$$w = (\lambda I + X^T X)^{-1} X^T Y$$

Figure 1: **Equation**

## 3 Our Experiment

### 3.1 Infrastructure

#### 3.1.1 Apache Spark

What is map reduce

How spark differentiates from its predecessors, hadoop yarn

Resilient Distributed Datasets (RDDs)

mllibs

add spark jira note

broadcasting rdd

//cite the mastering apache spark book [1]

a Spark cluster to be created on AWS EC2 storage.

New trends on spark <https://github.com/apache-spark-on-k8s/spark> cite this repository too.

### 3.2 Dataset

What is the dataset about. This dataset contains users, movies and the rating user made about the movies. This dataset is splited to multiple subsets of 80000 training sets and respective 20000 reviews. [3]

### 3.3 Metrics

#### 3.3.1 Mean Absolute Error

$$MAE = \frac{\sum_{i=1}^n |y_i - x_i|}{n} = \frac{\sum_{i=1}^n \sqrt{(y_i - x_i)^2}}{n} \quad (3)$$

#### 3.3.2 Execution Time

Time is measured in milliseconds.

## 4 Results

Table 1: Content Based Algorithm Results

Training Dataset	Testing Dataset	Mean Absolute Error	Execution time (ms)
u1.base	u1.test	1.6467431428213226	30514
u2.base	u2.test	1.6055222166704628	27714
u3.base	u3.test	1.608925907479106	27164
u4.base	u4.test	1.6259192043203685	26687
u5.base	u5.test	1.6284658627202895	27124
ua.base	ua.test	1.6425364580036836	26640
ub.base	ub.test	1.6357196576385744	26861

Table 2: Latent Factors Algorithm Results

Training Dataset	Testing Dataset	Mean Absolute Error	Execution time (ms)
u1.base	u1.test	1.1818684937209607	10195
u2.base	u2.test	1.1800652808093945	6517
u3.base	u3.test	1.1783366748334452	5377
u4.base	u4.test	1.1730543877181654	5433
u5.base	u5.test	1.1686585291940668	5217
ua.base	ua.test	1.2008035300836668	5214
ub.base	ub.test	1.2134460078406009	5083

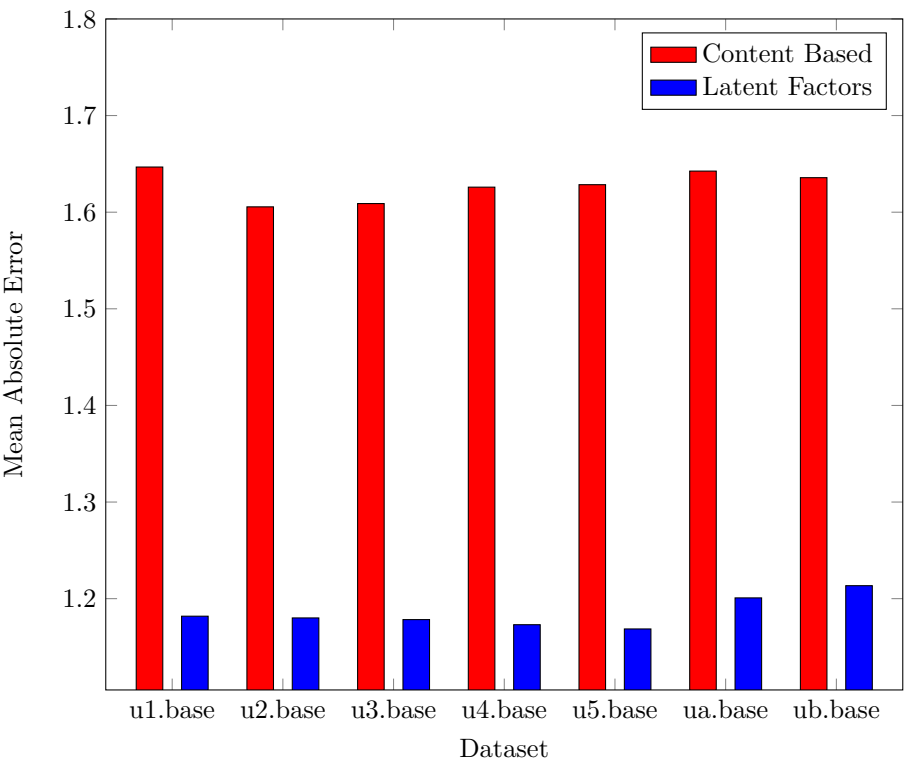


Figure 2: Latent Factors vs Content Based on Mean Absolute Value

husjdfslfdkjsafk

jhsdkfhksjhfkshf

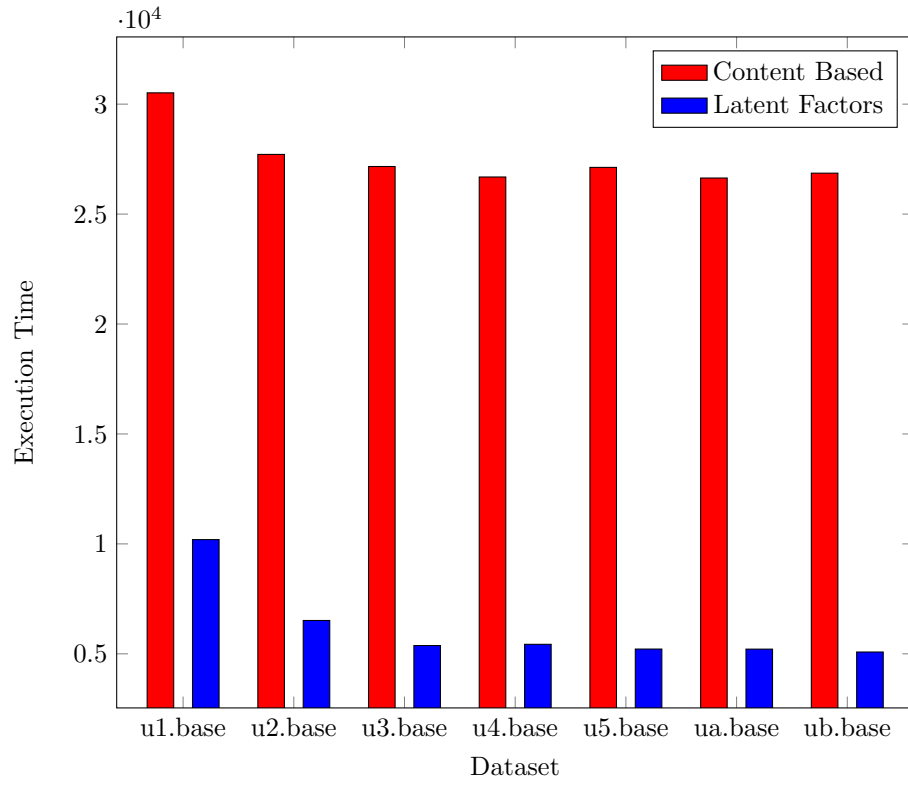


Figure 3: **Latent Factors vs Content Based on Execution Time**

## 5 Conclusion

As a conclusion we can see that als is better on both metrics from the content based.

## 6 References

### References

- [1] “Apache Spark lightning-fast cluster computing.” <https://spark.apache.org/>. Accessed: 2017-05-21.
- [2] P. Melville and V. Sindhwani, “Recommender systems,” *Encyclopedia of Machine Learning and Data Mining*, pp. 1056–1066, 2017.
- [3] “MovieLens grouplens.” <https://grouplens.org/datasets/movielens/>. Accessed: 2017-05-22.

## Part II

# Appendices

## A Code used

### A.1 User Based Collaborative Filtering

### A.2 Product Based Collaborative Filtering

### A.3 Latent Factors

### A.4 infra code

## B Metrics

### B.1 What is the mean absolute error

### B.2 Time

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