THE UTILITY PROBLEM OF WEB CONTENT POPULARITY PREDICTION

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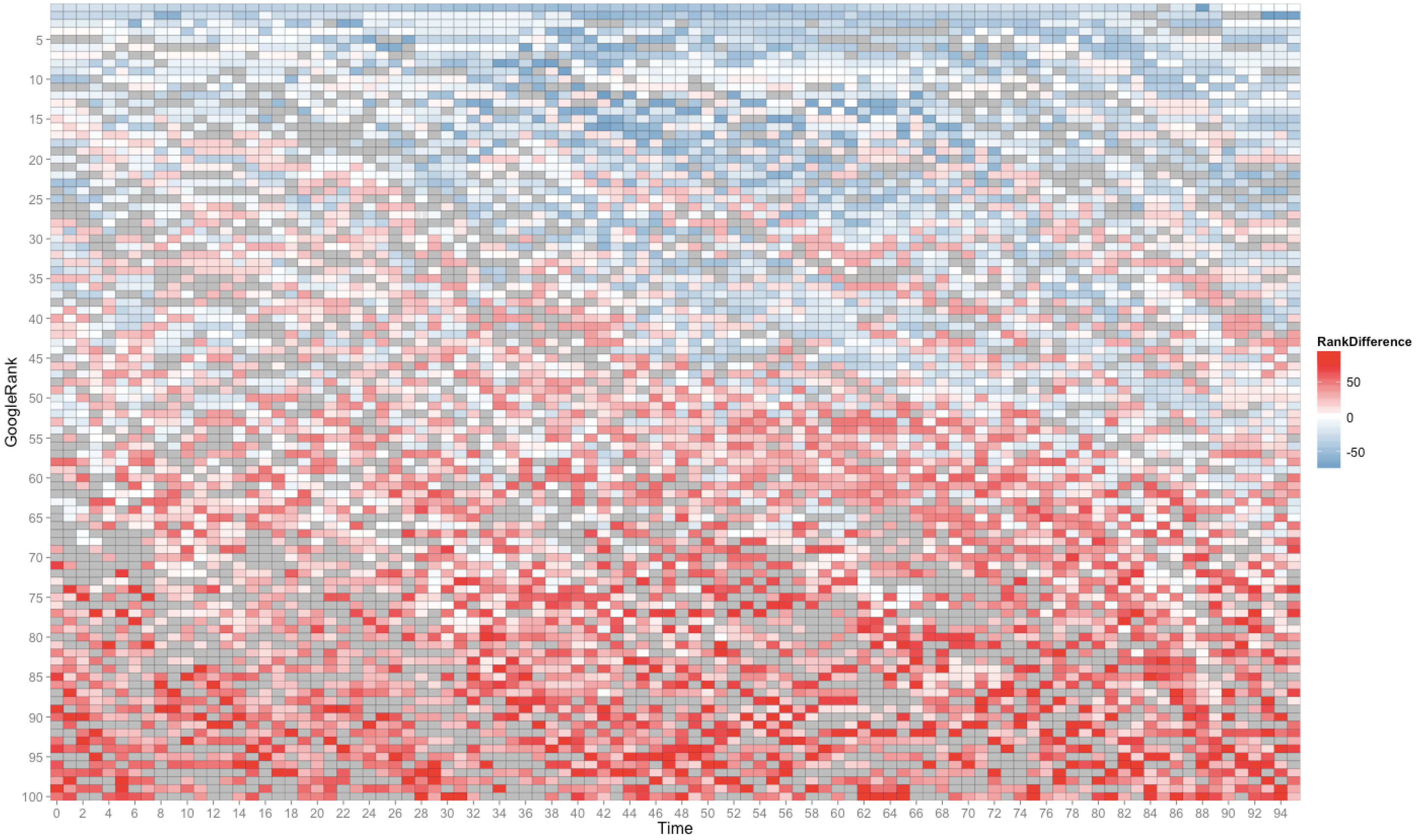
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Introduction

- Profusion of user-generated web content
- Imbalanced degree of attention received
- Great interest in anticipating such attention
- 10+ years of related work

Web Content Popularity Prediction

- Formalized as classification, regression, forecasting, etc.

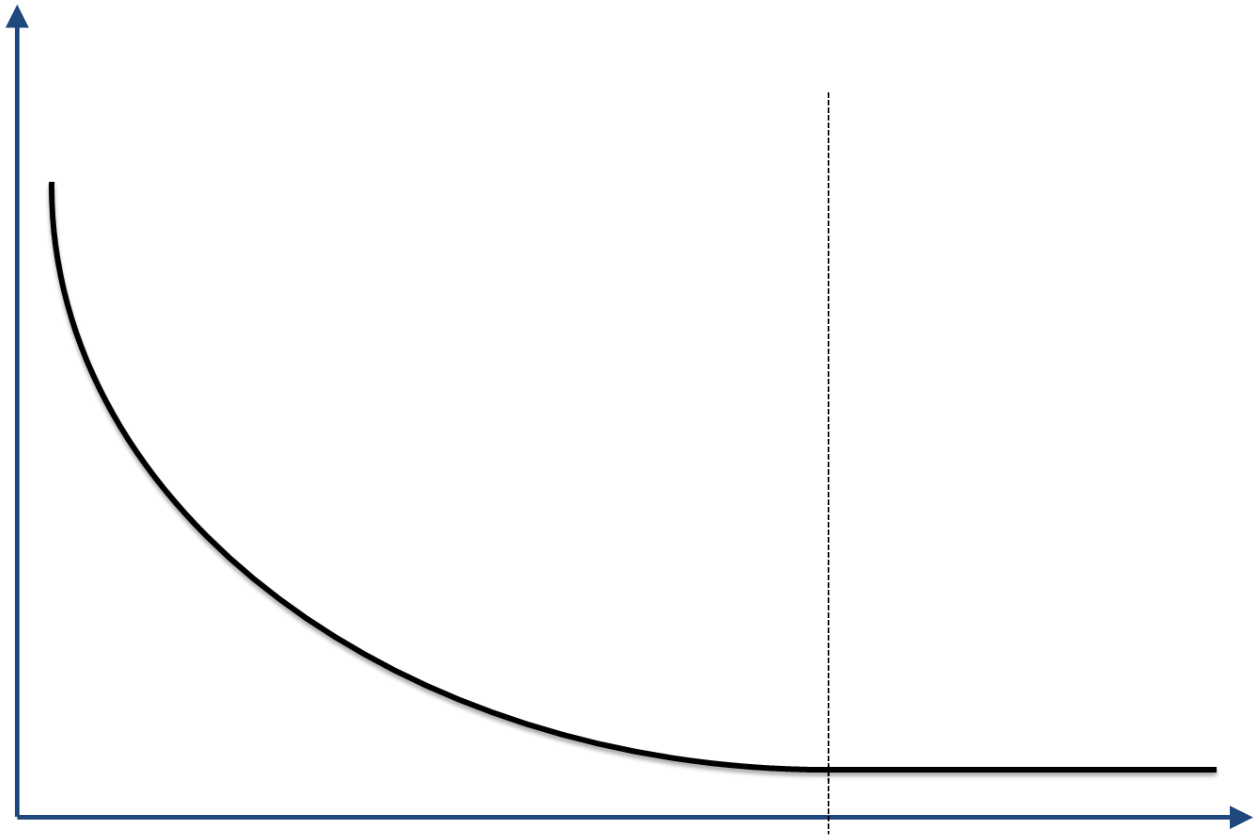
- Uses historical data to build prediction models in order to anticipate future popularity

Standard Assumption: Uniform Domain Preferences

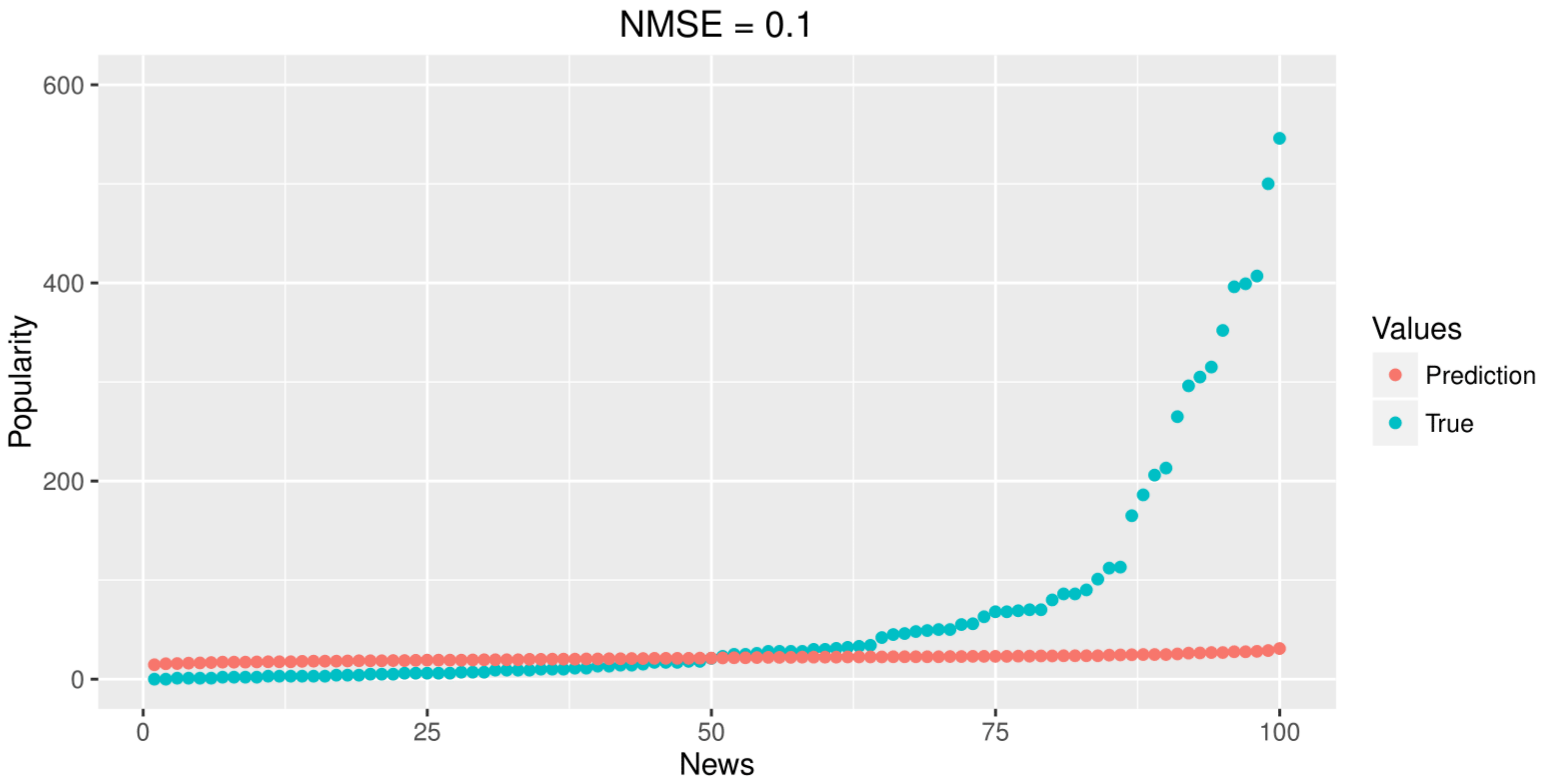
(in other words, every item is equally important)

What seems to be the problem?

- Popularity follows a heavy-tailed distribution



Evaluation/Optimization



Utility

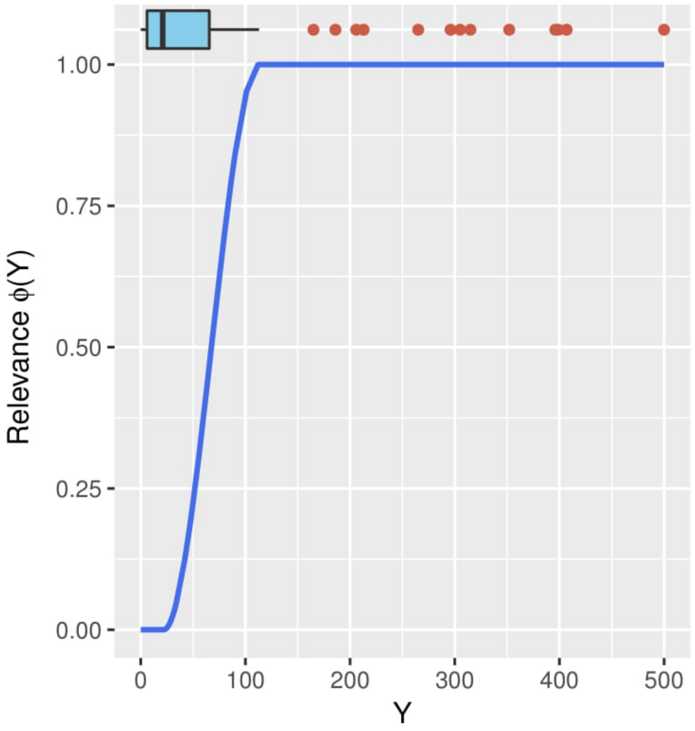
- Standard Learning Tasks

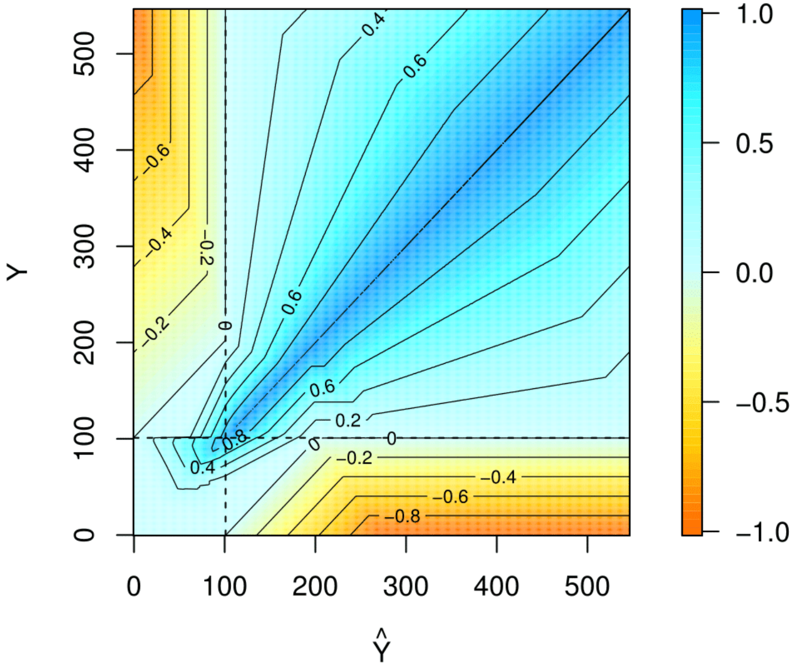
Equally accurate predictions have the same utility
More accurate predictions have greater utility
Less accurate predictions have lesser utility

- Utility-based Learning Tasks

Equally accurate prediction may have different utility
More accurate predictions may have lesser utility
Less accurate predictions may have greater utility

Utility-based Evaluation





Evaluation Metrics: Utility-based F-Score, Precision and Recall

Experimental Evaluation

- Task: Imbalanced Regression
- Methodology: Monte Carlo simulations

- Assumptions
  - Highly skewed distribution of target variable
  - Non-uniform domain preferences

- Data
  - News from Google News and Yahoo! News
  - Popularity from Facebook, Google+, LinkedIn
  - 20-minute slices
  - Available in UCI

Methods

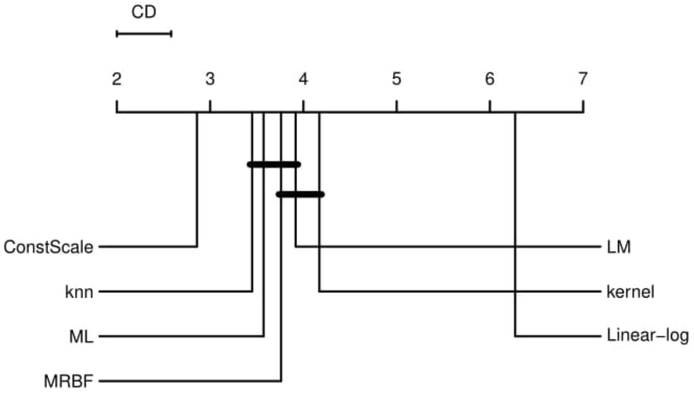
- Constant Scaling (Szabo and Huberman)
- Log-Linear (Szabo and Huberman)
- Multivariate linear regression (Pinto et al.)
- MLR with Radial Basis Functions (Pinto et al.)
- Linear with Sentiment Features (Asur and Huberman)

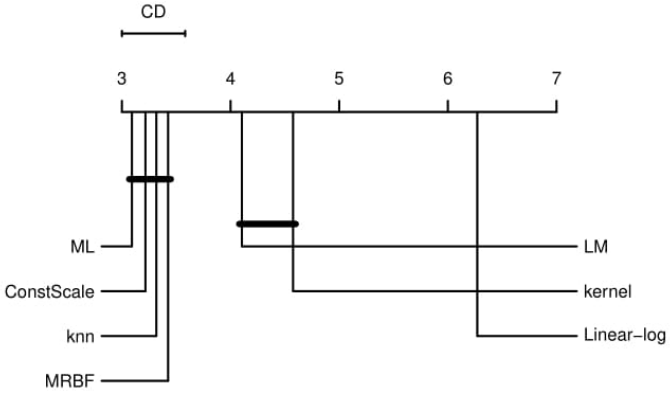
Proposals based on Imbalanced Domain Learning:

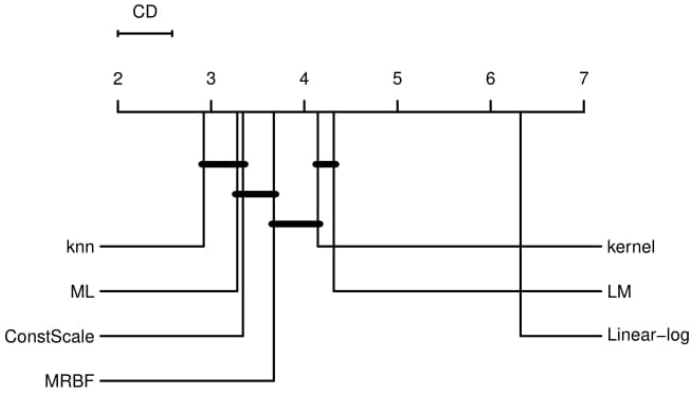
- Kernel-based Approach
- KNN-based Approach

Results – Predictive Analytics

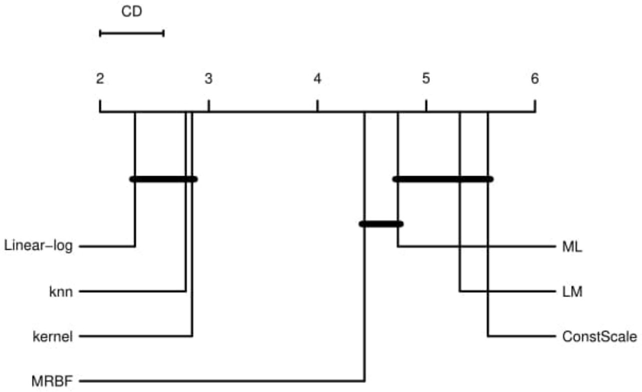
RMSE

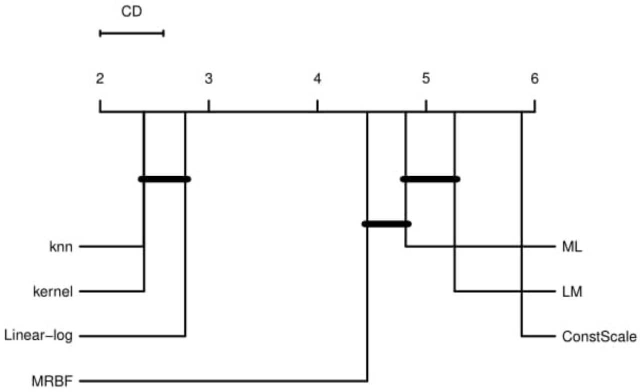


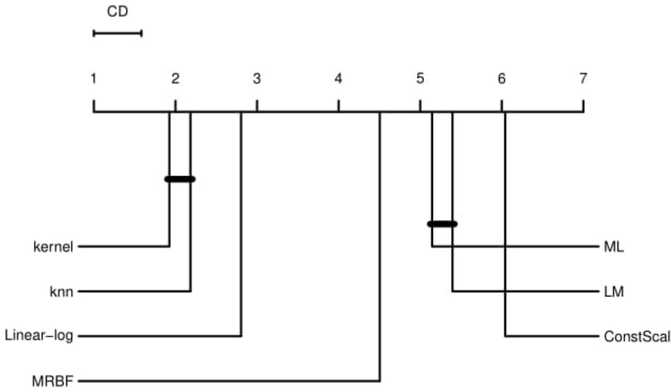




Utility-based F1-Score

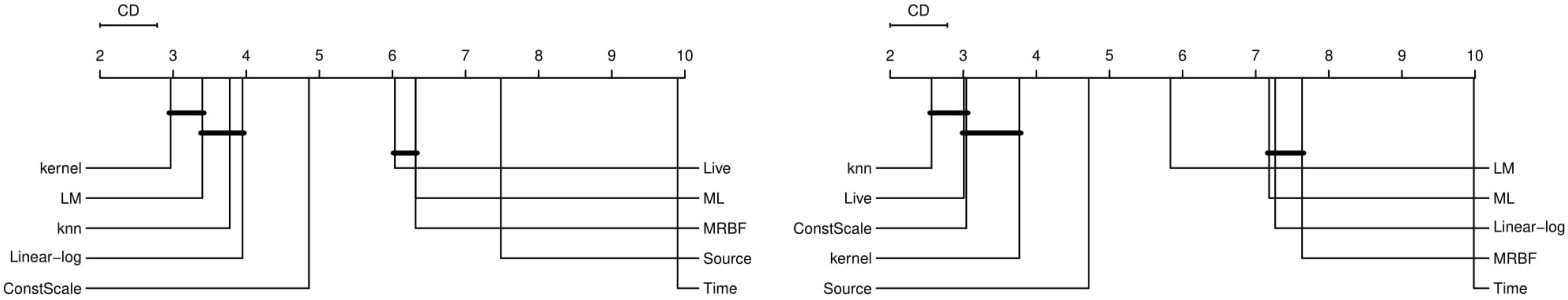






Results – Rankings

NDCG@10 (Google News & Yahoo! News)



Conclusions

- Previous proposals with best results in predicting average behaviour are within the worst in predicting the popularity of highly relevant cases;

- Simple local-based methods are capable of providing a better ability at predicting items with high levels of popularity;

- Utility-based formalization enables better results in ranking proposals concerning timely suggestions of highly popular content.

Thank you! Questions?

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