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Factorization Machines for Blog Feedback Prediction

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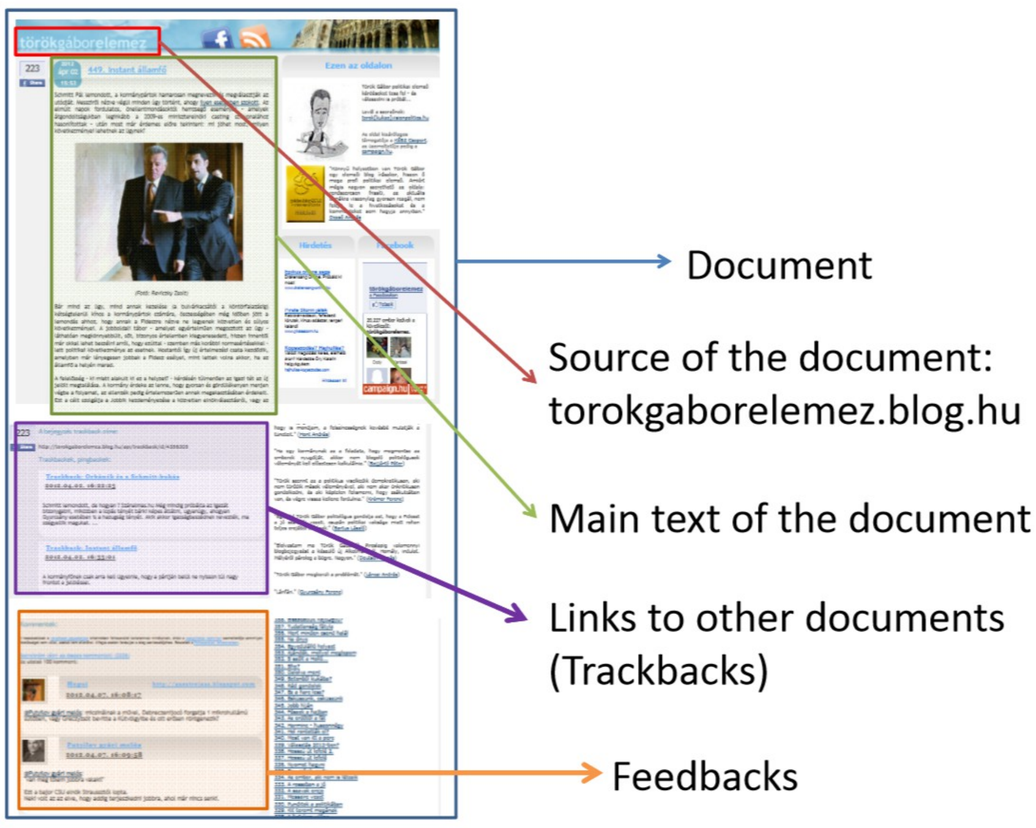
1 Introduction

Blog Feedback Prediction Problem [1]
- early recognition of highly influential blog posts
- the number of feedbacks (comments) is used to quantify influence



2 Factorization Machine

Given an instance $x = (x_1, \dots, x_n)$, a factorization machine [2] of second degree with f factors predicts its label as follows:

$$\hat{y}(\mathbf{x}) = w_0 + \sum_{i=1}^{n} w_i x_i + \sum_{i=1}^{n} \sum_{j=i+1}^{n} \left(\sum_{k=1}^{f} v_{i,k} v_{j,k} \right) x_i x_j$$

where $w_0, \dots, w_n$ and $v_{1,1}, \dots, v_{n,f}$ are parameters of the model. The later describe the interactions between features, while we refer to $w_1, \dots, w_n$ as *feature weights*.

3 Training

Algorithm 1 Training the Factorization Machine

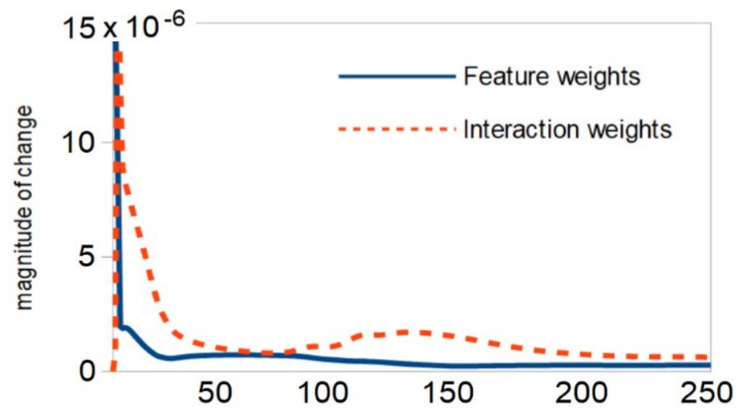
Require: Training data D, number of epochs e, learning rate η, standard deviation σ
Ensure: Weights $w_0, w_1, \dots w_k$ and $v_{1,1}, \dots, v_{n,f}$

Initialize $w_0, w_1, \dots w_k$ and $v_{1,1}, \dots, v_{n,f}$ from standard normal distribution with zero mean and standard deviation σ
for epoch in $1 \dots e$ **do**
  for each $(x, y) \in D$ in random order **do**
    $\hat{y} \leftarrow w_0 + \sum_{i=1}^{n} w_i x_i + \sum_{i=1}^{n} \sum_{j=i+1}^{n} \left(\sum_{k=1}^{f} v_{i,k} v_{j,k} \right) x_i x_j$
    $w_0 \leftarrow w_0 - \eta \, 2(\hat{y} - y)$
    for i in $1 \dots k$ **do**
      $w_i \leftarrow w_i - \eta \, 2(\hat{y} - y) x_i$
    end for
    for i in $1 \dots n$ **do**
      for j in $1 \dots f$ **do**
        $v_{i,j} \leftarrow v_{i,j} - \eta \, 2(\hat{y} - y) \left(x_i \sum_{k=1}^{n} v_{k,j} x_k - v_{i,j} x_i^2 \right)$
      end for
    end for
  end for
end for
return $w_0, w_1, \dots, w_k$ and $v_{1,1}, \dots, v_{n,f}$

4 Results

Data: UCI Repository, Blog Feedback Data*

	Linear regression	FM, $f = 3$
AUC@10	0.864	0.869
Hits@10	4.733	5.117



* https://archive.ics.uci.edu/ml/datasets/BlogFeedback

Acknowledgement

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References

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[2] Rendle, S.: Factorization machines. 10th International Conference on Data Mining (ICDM), pp. 995–1000. IEEE (2010)