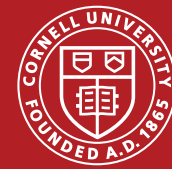


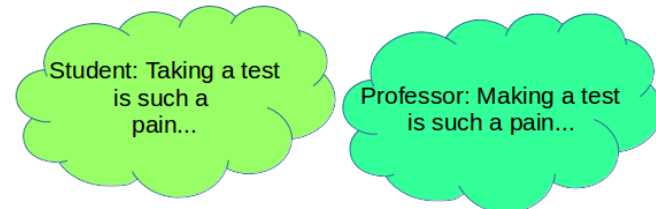
Automatic Assessment Generation via Machine Learning

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The Problem

No automated tools available that generate an assessment through which user can test his/her skills



- Available methods to generate/prepare a test requires an excessive amount of human (generally a teacher or domain expert) effort
- The traditional approach to assessment generation does not scale to test in multiple fields or even personalized tests

Proposed Solution

We use machine learning to automatically generate assessment using already available million of questions and answers from websites like stackoverflow.com

- No (or only little) human effort required and we can generate new assessments almost instantly and personalize them
- We can easily mix both theoretical and practical questions

Challenge: How to learn interesting hidden variables like difficulty of question, quality of answers, ability of users

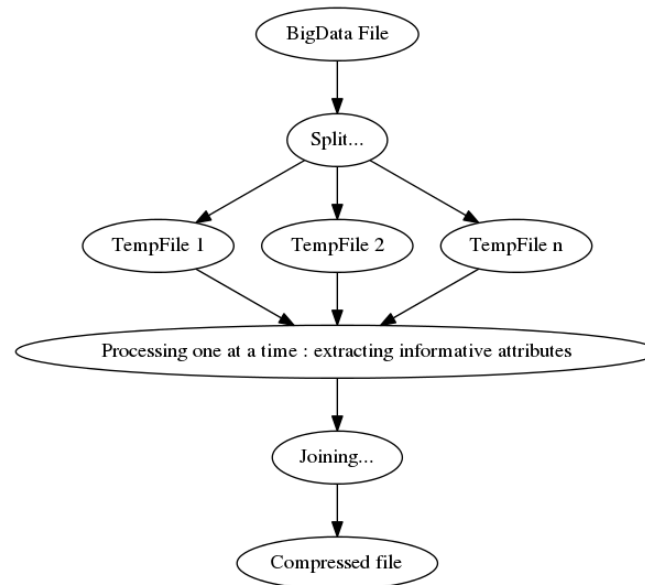
Dataset



- 130+ stackexchange websites, most famous one is stackoverflow.com
- Number of users = 5,277,830 (~ 5 million), file size 1.5 GB
- Number of posts (Question + Answers) = 29,499,662 (~ 30 million), file size 45 GB
- Number of votes = 98,928,934 (~ 99 million), file size 9 GB

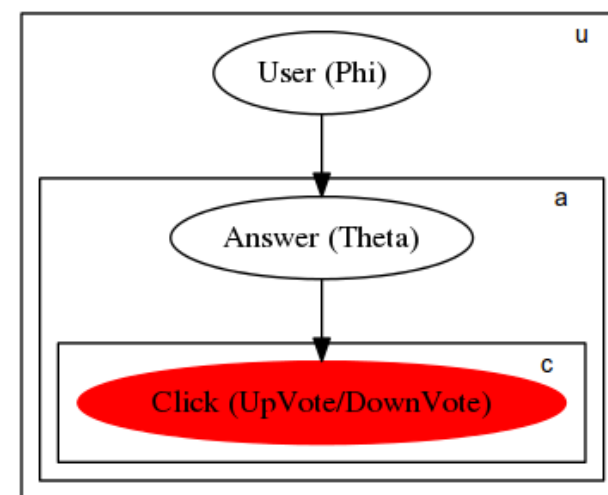
Pre-processing of Big Data

To process such large files, we broke them into several smaller files and processed them separately



Algorithm: Statistical model for answer quality and user ability

We used the following probabilistic graphical model to characterize the hidden parameters of interest



$$P(\theta, \phi | clicks) \propto P(clicks | \theta, \phi) * P(\theta, \phi)$$

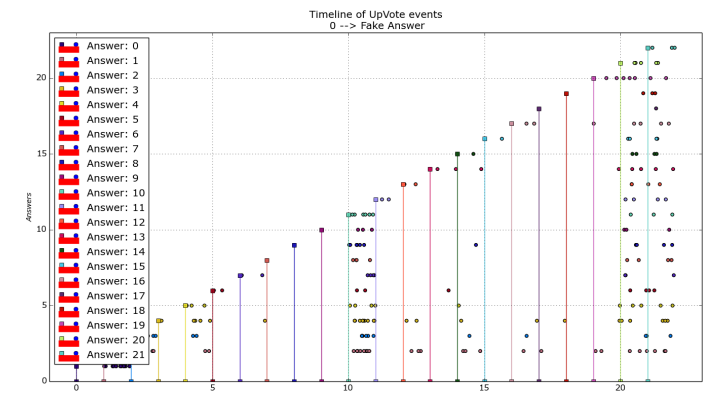
$$P(\theta, \phi | clicks) \propto P(clicks | \theta) * P(\theta | \phi) * P(\theta)$$

$$P(click = k | \theta_1, \dots, \theta_n) = \frac{\exp(\theta_k)}{\exp(\theta_1) + \dots + \exp(\theta_n)}$$

$$P(\theta_i | \phi_j) \sim \mathcal{N}(\phi_j, \sigma^2)$$

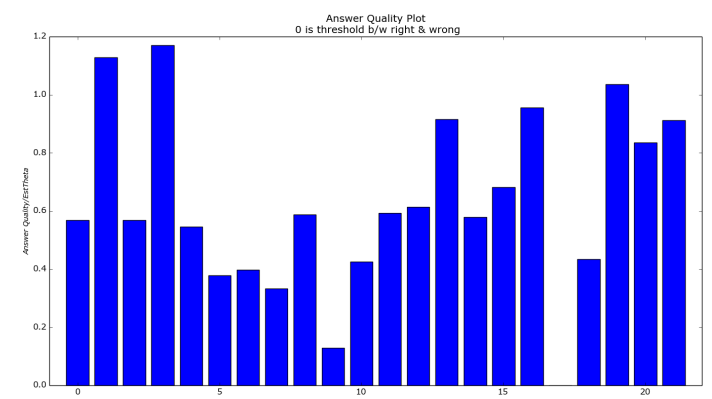
$$P(\phi_j) \sim \mathcal{N}(0, \sigma^2)$$

Time-line of a typical question

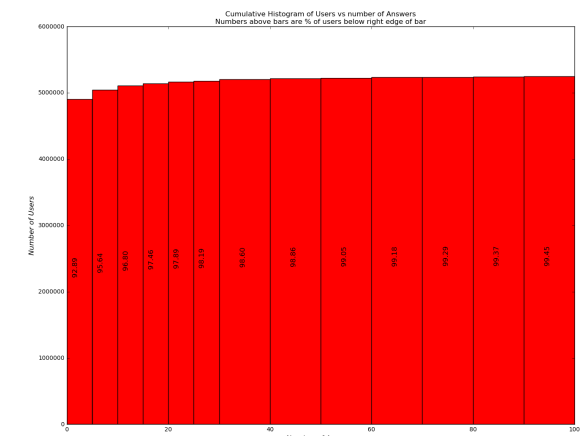


- Shows the entire vote and answer generation history of a particular question capturing the number of answers
- Each dot captures a click event (up-vote or down-vote)

We can learn the quality for every answer in above time line



Cumulative Histogram of # of Answers vs Users



Other Applications

- Get the ranking of all users
- Extract learning curve of users