Research Methods in computer science

Fall 2014

Lecture 5

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Agenda

Research Conference Updates

Experiment Design

Metric Design

Experiments

Hypothesis

Scenarios

Measurements

Conclusions

Types of Experiments

Model / Analysis

Simulations

Testbed (Real word ^{lite})

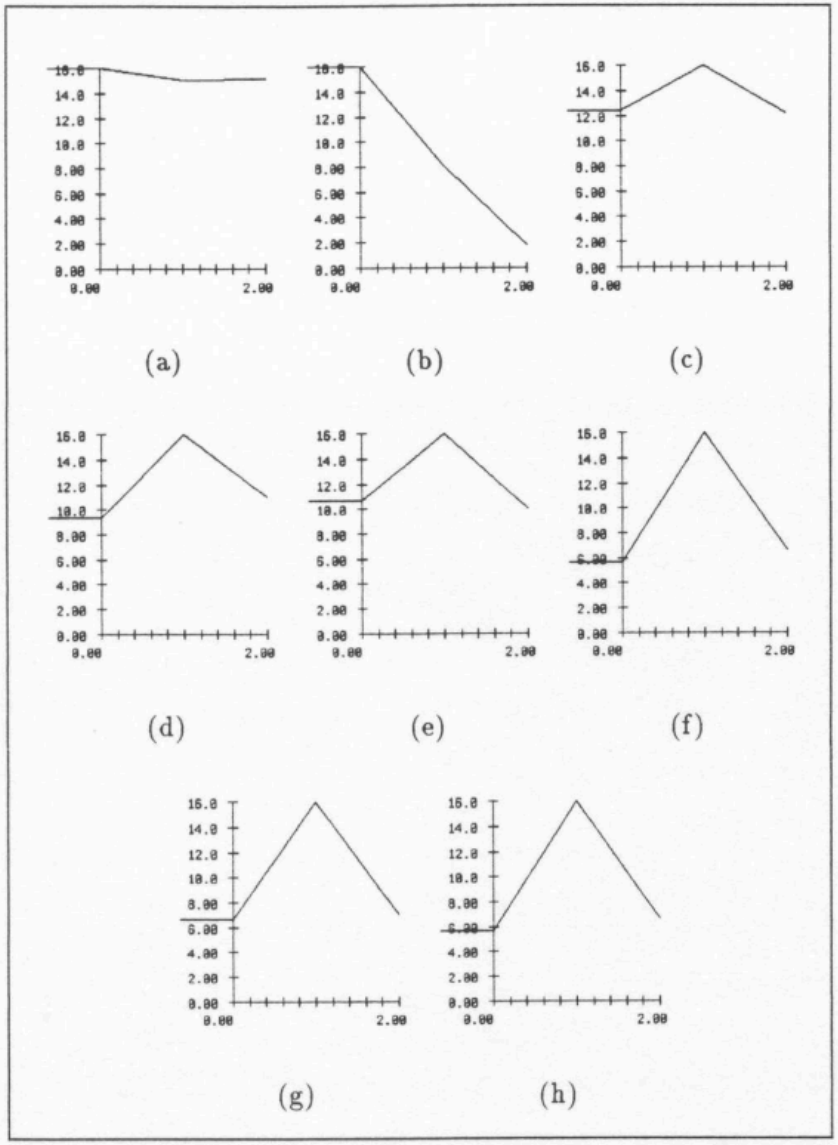
“Real world”

Which one to use when?

Eigenfaces for Recognition

[Turk ’91]

“We have developed a near-real-time computer system that can locate and track a subject’s head, and then recognize the person by comparing the characteristics of the face to those of known individuals.”



Scenarios and metrics from [Turk '91]

Figure 9. Results of experiments measuring recognition performance using eigenfaces. Each graph shows averaged performance as the lighting conditions, head size, and head orientation vary—the *y*-axis depicts number of correct classifications (out of 16). The peak (16/16 correct) in each graph results from recognizing the particular training set perfectly. The other two graph points reveal the decline in performance as the following parameters are varied: **(a)** lighting, **(b)** head size (scale), **(c)** orientation, **(d)** orientation and lighting, **(e)** orientation and size (#1), **(f)** orientation and size (#2), **(g)** size and lighting, **(h)** size and lighting (#2).

The Anatomy of a Large-Scale Hypertextual Web Search Engine

[Brin and Page ’98]

What hypothesis, scenarios, and metrics should we expect to see in this paper?

5 Results and Performance

The most important measure of a search engine is the quality of its search results. While a complete user evaluation is beyond the scope of this paper, our own experience with Google has shown it to produce better results than the major commercial search engines for most searches. As an example which illustrates the use of PageRank, anchor text, and proximity, Figure 4 shows Google's results for a search on "bill clinton". These results demonstrates some of Google's features. The results are clustered by server. This helps considerably when sifting through result sets. A number of results are from the whitehouse.gov domain which is what one may reasonably expect from such a search. Currently, most major commercial search engines do not return any results from whitehouse.gov, much less the right ones. Notice that there is no title for the first result. This is because it was not crawled. Instead, Google relied on anchor text to determine this was a good answer to the query. Similarly, the fifth result is an email address which, of course, is not crawlable. It is also a result of anchor text.

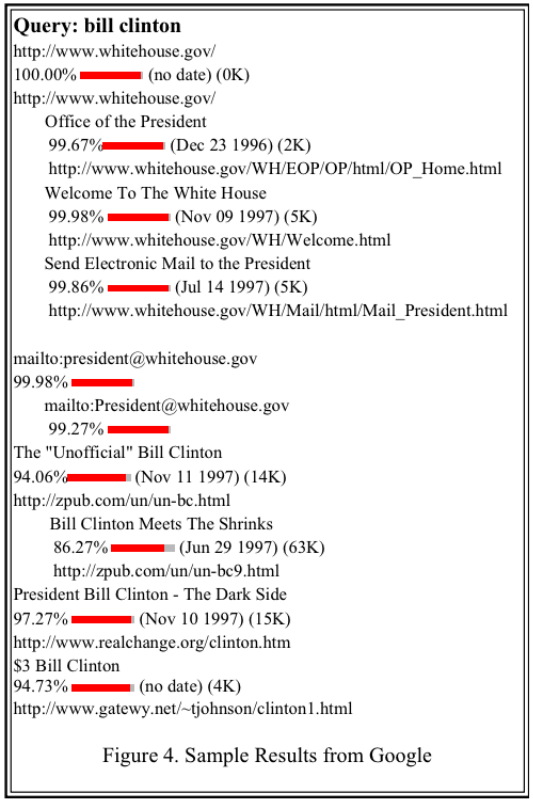


Figure 4. Sample Results from Google

All of the results are reasonably high quality pages and, at last check, none were broken links. This is largely because they all have high PageRank. The PageRanks are the percentages in red along with bar graphs. Finally, there are no results about a Bill other than Clinton or about a Clinton other than Bill. This is because we place heavy importance on the proximity of word occurrences. Of course a true test of the quality of a search engine would involve an extensive user study or results analysis which we do not have room for here. Instead, we invite the reader to try Google for themselves at http://google.stanford.edu.

[Brin and Page '98]

Storage Statistics	
Total Size of Fetched Pages	147.8 GB
Compressed Repository	53.5 GB
Short Inverted Index	4.1 GB
Full Inverted Index	37.2 GB
Lexicon	293 MB
Temporary Anchor Data (not in total)	6.6 GB
Document Index Incl. Variable Width Data	9.7 GB
Links Database	3.9 GB
Total Without Repository	**55.2 GB**
Total With Repository	**108.7 GB**

Web Page Statistics	
Number of Web Pages Fetched	24 million
Number of Urls Seen	76.5 million
Number of Email Addresses	1.7 million
Number of 404's	1.6 million

Table 1. Statistics

[Brin and Page '98]

Why did the authors decide to report these measurements?

Human Action Recognition by Representing 3D Skeletons as Points in a Lie Group

[Vemulapalli ’14]

“Most of the existing skeleton-based approaches use either the joint locations or the joint angles to represent a human skeleton. In this paper, we propose a new skeletal representation that explicitly models the 3D geometric relationships between various body parts using rotations and translations in 3D space.”

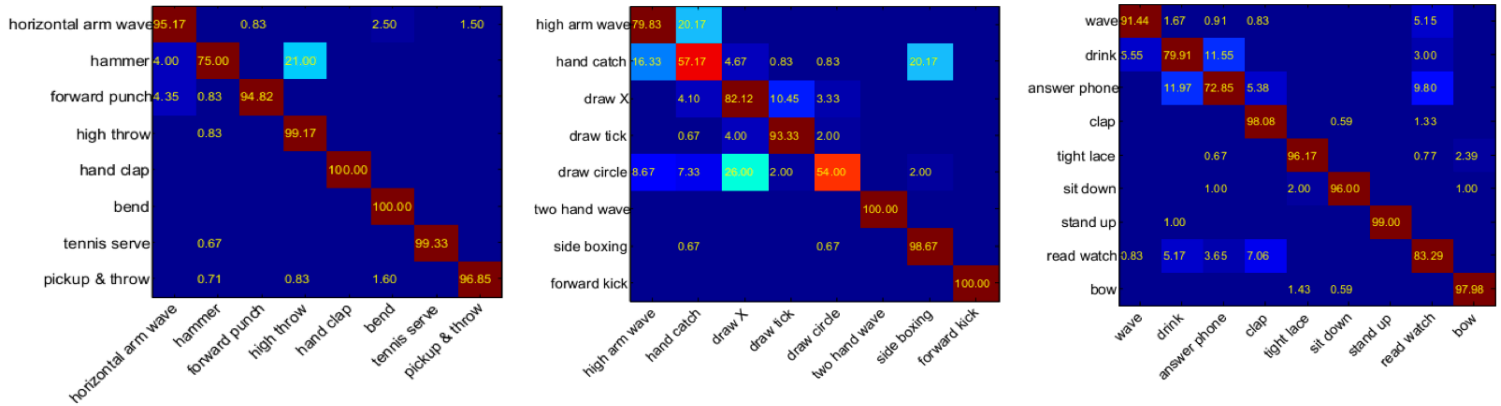


Figure 5: Confusion matrices: Left – MSR-Action3D AS_1; Center - MSR-Action3D AS_2; Right – Florence3D-Action

Note the use of standard datasets

Metric and Experiment Design Exercise

Project: An instruction system that improves student learning.

Possible metrics: ?

Metric Survey Exercise

List and define all the metrics used in the ten research papers from HW2.

We will collect them and look at them together in next class.