

# Research Methods in computer science

Spring 2017

Lecture 9

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# Agenda

HW4 Live Grading

Conference Organization Updates

Experiments

Assignment

# Conference Organization

## Different roles

General Chair

Finance Chair

Arrangement Chair

Technology Chair

Program Chair

Publication Chair

Technical Program Committee

## Schedule for activities

# Sample Hypotheses

Only an extraordinarily skilled attacker can break into our firewall. [?]

The firewall accepts all well-formed packets and sessions, and handles malformed packets and sessions as documented in the firewall's manual.

# Types of Experiments

Model / Analysis

Simulations

Testbed (Real world <sup>lite</sup>)

“Real world”

Which one to use when?

# Metric

Why do we want to measure?

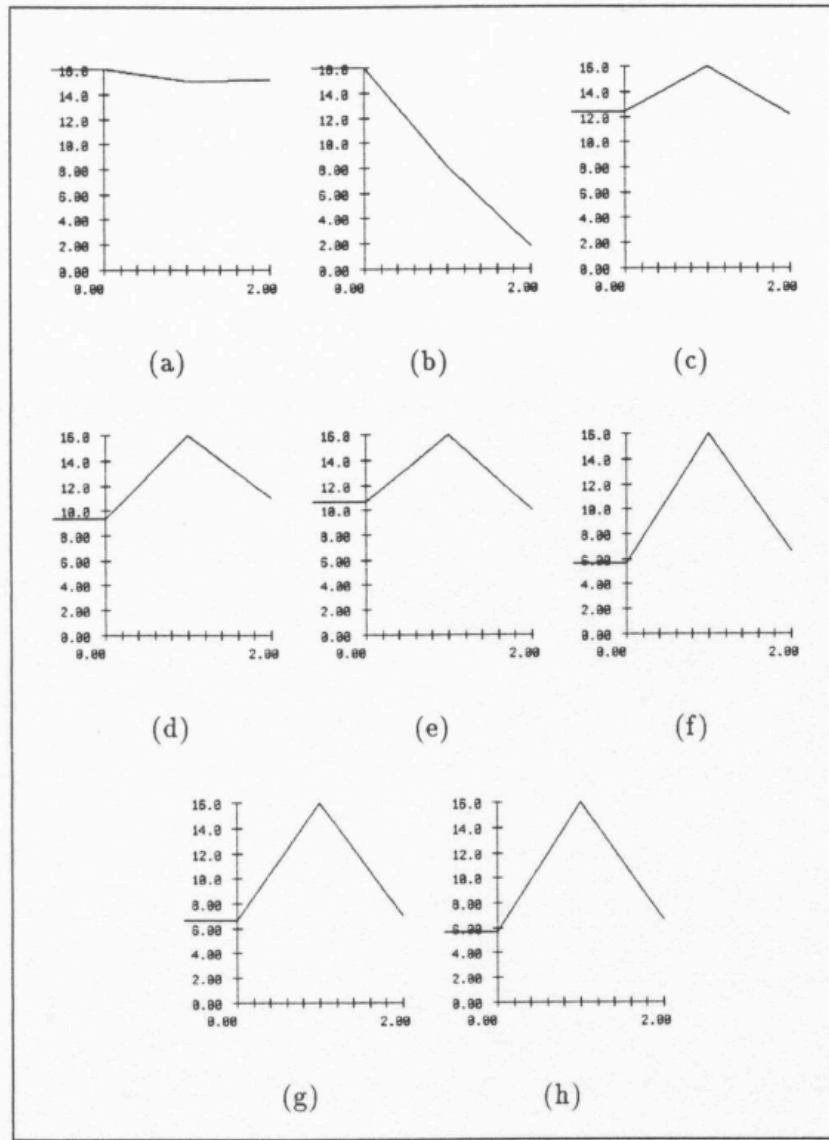
What to measure?

# 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.

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]

| <b>Storage Statistics</b>                   |                 |
|---|-----------------|
| 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<br>(not in total)     | 6.6 GB          |
| Document Index Incl.<br>Variable Width Data | 9.7 GB          |
| Links Database                              | 3.9 GB          |
| <b>Total Without Repository</b>             | <b>55.2 GB</b>  |
| <b>Total With Repository</b>                | <b>108.7 GB</b> |

| <b>Web Page Statistics</b>     |              |
|--------------------------------|--------------|
| Number of Web Pages<br>Fetched | 24 million   |
| Number of Urls Seen            | 76.5 million |
| Number of Email<br>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?

# Metrics/Experiments?

Accurately Initializing Real Time Clocks to Provide Synchronized Time in Sensor Networks

CTP: An Efficient, Robust, and Reliable Collection Tree Protocol for Wireless Sensor Networks

On the Effectiveness of Energy Metering on Every Node

Surviving Sensor Network Software Faults

# Group Activity

Experiment Design

Metric Selection

A new algorithm that translates English text to Spanish.

A new wireless networking technology.

A new algorithm that can identify the person in an image.



# HW5 – Experiments

Identify missing/not useful experiments.