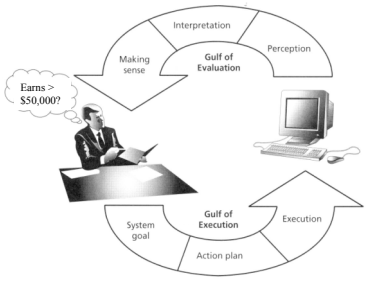
Lecture 13

Chapter 13 Information Search and Visualization

Information Search and Visualization

- Who earns > $50,000 among the residents of Eugene, Oregon?

Stages of Action in Human-Computer Interaction



Introduction

- **Information activities:**
  - Information gathering
    - Knowing where to look and availability
    - Searching versus Browsing
    - A know-item-search versus making sense and discovering
    - Filtering
  - Information evaluation
    - Is this what I want?
  - Information analysis and interpretation
    - Summarizing information
    - Comparing information
- **Information activities are on-going, iterative tasks**
  - Interruption and resumption
  - Trace of the information gathering tasks
  - Archiving and annotating

Introduction

- **Problem: Huge volumes of computer-stored data available:**
  - Databases
    - Textual document libraries
      - Structured Relational Databases
        - » contains relations and a schema to describe the relations
        - » relations have records
        - » records have fields, and fields have values
        - » set of items (10 to 100,000)
    - Multimedia document librairies
      - Contains images, sound, video, animations, etc
      - Digital archives are more loosely organized
      - Directories contain metadata
  - Websites
    - Contains network of websites with network of web pages
    - Gigantic information resource
    - Contents include text, sound, graphics, video, programs
  - Websites and Databases: Data mining
  - Data warehouses and data marts
  - Knowledge networks or semantic webs

Introduction

BUT searching and discovering is difficult:

- **Traditional interfaces have been difficult for novice users**
  - Command Languages
    - Complex commands
    - Boolean operators
    - Unwieldy concept
    - EXAMPLE: SQL query language to relational databases
- **Traditional interfaces have been inadequate for expert users**
  - Difficulty in repeating searches across multiple databases
  - Weak methods for discovering where to narrow broad searches
  - Poor integration with other tools

Introduction

- **Solution: Developing more powerful search and visualization methods, integration of technology with task**
  - Searching in Textual Documents and Database Querying (Chapter 14.2)
    - Form fillin in HTML instead of SQL query language
    - Customizable search options and displays using control panels
    - Natural language integration into text searching
      - Google uses statistical frequency of co-occurrence of words to determine meaning
  - Multimedia Document Searches (Chapter 14.3)
    - Pattern recognition for picture searching
  - Advanced Filtering and Search Interfaces (Chapter 14.4)
  - Designers are just learning how to present large amounts of data in orderly and user-controlled ways (Chapter 14.5)
    - "Information Visualization"

Searching in textual documents and database querying (Chap 14.2)

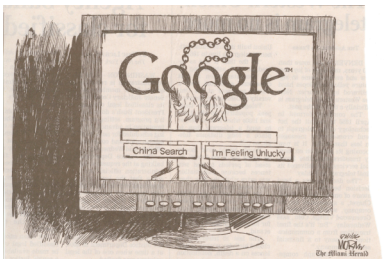
- Traditional information finding resources
  - Finding aides
    - Table of contents, Indexes, Description introductions, Subject classification, Key-Word-In-Context (KWIC)
  - Preview and overview surrogates
- Searching in structured relational database systems well established task using SQL command language
  - Users write queries that specify matches on attribute levels
  - Example of SQL command
    - SELECT DOCUMENT#
    - FROM JOURNAL-DB
    - WHERE (Date >= and Date<= 1998)
    - and (Language = English or French)
    - and (publisher = ASIST or HFES or ACM).
  - SQL has powerful features, but it requires 2 to 20 hours training
  - While SQL is a standard form-fillin queries have simplified query formulation
  - Finding a way not to overwhelm novice users is a challenge

Searching in textual documents and database querying

- New searching and querying interfaces
  - WWW search engines
    - Google, Yahoo, etc.
    - Natural language integration into text searching
      - Google uses statistical frequency of co-occurrence of words to determine meaning
    - World Wide Web search engines have greatly improved their performance by using statistical ranks and the information in the web's hyperlink structure
  - WWW to Database interfaces
    - Form fillin in HTML instead of SQL query language
    - Customizable search options and displays using control panels
- Evidence shows that users perform better and have higher satisfaction when they can view and control the search

Searching in textual documents and database querying

- Ethical problems



Searching in textual documents and database querying

- Searching & Querying User Interfaces: Basic tasks
  - Overview
    - Gain an overview of the entire collection
    - Adjoining detail view
    - The overview might contain a movable field-of-view box to control the contents of the detail view
      - allowing zoom factors of 3 to 30
    - Fisheye view
  - Zoom
    - Zoom in on items of interest
    - Allows a more detailed view
    - Need to maintain context
    - Particularly important for small displays
  - Filter
    - Filter out uninteresting items
    - Allows user to reduce size of search

Searching in textual documents and database querying

- User Interfaces: Basic tasks (cont.)
  - Details-on-Demand
    - Select an item or group and get details when needed
    - Useful to pinpoint a good item
    - Usually click on an item and review details in a separate or pop-up window
  - Relate
    - View relationships among items
    - Use human perceptual ability – proximity, containment, connected line, color coding
    - Example: Set director's name, and view all movies with that director
  - History
    - Keep a history to allow undo, replay, and progressive refinement
    - Allows a mistake to be undone, or a series of steps to be replayed
  - Extract
    - Extract the items or data
    - Save to file, print, or drag to another application

Searching in textual documents and database querying

- Example: ZFIN database
  - WWW Genetics database for zebrafish
  - Used by international research scientists
  - Developed at UO by S.Douglas (CS) and Monte Westerfield (Neuroscience Institute), 1994-2005

<http://zfin.org>
Search for gene “cox”
Search for mutant “cyclops”

Multimedia document searches (Chapter 14.3)

- Searches for databases and textual documents are good, but multimedia searches are in a primitive stage
- Current multimedia searches require descriptive documents or metadata searches
- Search by date, text captions, or media is possible
- Useful to have computers perform some filtering
- New systems will incorporate powerful annotation and indexing, with better search algorithms and browsing

Multimedia document searches (Chapter 14.3)

- Image Search:
  - Finding photos with images such as the Statue of Liberty is a challenge
    - Query-by-Image-Content (QBIC) is difficult
    - Search by profile (shape of lady), distinctive features (torch), colors (green copper)
  - Use simple drawing tools to build templates or profiles to search with
  - More success is attainable by searching restricted collections
    - Search a vase collection
    - Find a vase with a long neck by drawing a profile of it
  - Critical searches such as fingerprint matching requires a minimum of 20 distinct features
  - For small collections of personal photos effective browsing and lightweight annotation are important

Multimedia document searches (Chapter 14.3)

- Map Search
  - On-line maps are plentiful
  - Search by latitude/longitude is the structured-database solution
  - Today's maps are allow utilizing structured aspects and multiple layers
    - City, state, and site searches
    - Flight information searches
    - Weather information searches
    - Example: www.mapquest.com
  - Mobile devices can allow “here” as a point of reference

Multimedia document searches (Chapter 14.3)

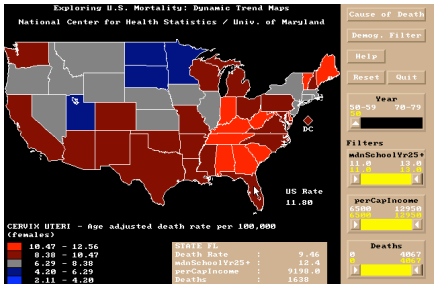
- Design/Diagram Searches
  - Some computer-assisted design packages support search of designs
  - Allows searches of diagrams, blueprints, newspapers, etc.
    - E.g. search for a red circle in a blue square or a piston in an engine
  - Document-structure recognition for searching newspapers
- Sound Search
  - MIR supports audio input
  - Search for phone conversations may be possible in future on speaker independent basis
- Video Search
  - Provide an overview
  - Segmentation into scenes and frames
  - Support multiple search methods
  - Infomedia project
- Animation Search
  - Prevalence increased with the popularity of Flash
  - Possible to search for specific animations like a spinning globe
  - Search for moving text on a black background

Advanced filtering and search interfaces (Chap 14.4)

For advanced uses there are alternatives to form fillin query interfaces:

- Filtering with complex boolean queries
  - Problem with informal English, e.g. use of ‘and’ and ‘or’
  - Venn diagrams, decision tables, and metaphor of water flowing have not worked for complex queries
- Dynamic Queries - Adjusting sliders, buttons, etc and getting immediate feedback
  - “direct-manipulation” queries
  - Use sliders and other related controls to adjust the query
  - Get immediate (less than 100 msec) feedback with data
  - Dynamic HomeFinder and Blue Nile
  - Hard to update fast with large databases
- Query previews present an overview to give users information and the distribution of data and thereby eliminate undesired items
- Faceted metadata search
  - Integrates category browsing with keyword searching
  - Flameco

Interactive Graphics



Advanced filtering and search interfaces (Chap 14.4)

- Collaborative Filtering
  - Groups of users combine evaluations to help in finding items in a large database
  - User "votes" and her/his info is used for rating the item of interest
  - E.g. a user rating sex restaurants highly is given a list of restaurants also rated highly by those who agree the six are good
- Multilingual searches
  - Current systems provide rudimentary translation searches
  - Prototypes of systems with specific dictionaries and more sophisticated translation
- Visual searches
  - Specialized visual representations of the possible values
  - E.g. dates on a calendar or seats on a plane
  - On a map the location may be more important than the name
  - Implicit initiation and immediate feedback

Summary

Problem: Huge volumes of computer-stored data available

- Databases
  - Structured relational Databases
  - Multimedia document libraries
- Websites
- Websites and Databases: Data mining

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