Beyond Document Similarity: Understanding Value-Based Search and Browsing Technologies

Andreas Paepcke

Hector Garcia-Molina

Gerard Rodriguez-Mula (Spain)

Junghoo Cho

ACM SIGMOD Record, 29(1): 80-92, March 2000.

Outline

- Introduction
- Conceptual Architecture
- Content-based Value Filtering
- Action-based Value Filtering
- Summary

Date	Submitted to
5/18/1999	ACM Computing Surveys
2/4/1999	DL99
11/17/1998	WWW'99 conference

Introduction

- **Problem**
  - Current IR systems: searching and ranking
    - **one or two words per query ⇒ high volumes of documents on the Web**
    - **multimedia data ⇒new techniques beyond similarity measure**
- **Solution**
  - Value filtering approaches
    - **indicators of information value**
      - independent of similarity with any given query
    - **help users throttle the flow of information**
    - **attach searchable index to non-textual data**

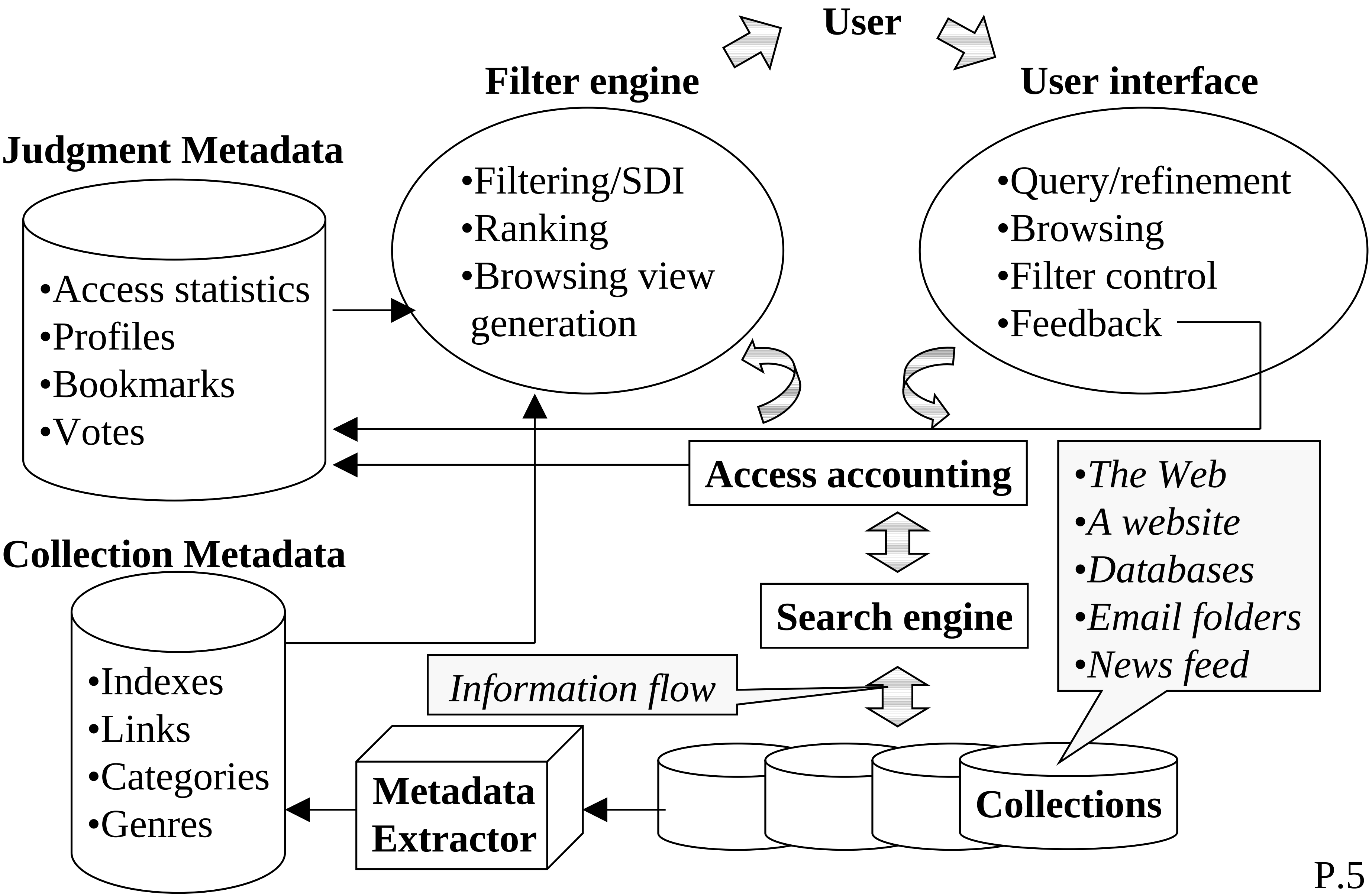
Introduction

- **Example**
  - Query
    - 購買中古汽車
  - Conditions of similarity measure
    - 跑車、超強馬力
    - 深色系、流線型
  - Indicators of information value
    - 經銷商、原車主
    - 可議售價、出廠年份、使用情況
    - 市場評價、個人偏好

Introduction

- **Possible Techniques**
  - Explicit user participation
  - Automatic extraction from documents
  - Observation of user accesses
- **Applications**
  - Search: cull documents among query results
  - Rank: help user digest a number of results
  - Browse: guide users with valuable links
  - Filter: selective dissemination of information
  - Cache: indexing of highly valuable information

Conceptual Architecture



User

Filter engine

- Filtering/SDI
- Ranking
- Browsing view generation

User interface

- Query/refinement
- Browsing
- Filter control
- Feedback

Judgment Metadata

- Access statistics
- Profiles
- Bookmarks
- Votes

Access accounting

- *The Web*
- *A website*
- *Databases*
- *Email folders*
- *News feed*

Collection Metadata

- Indexes
- Links
- Categories
- Genres

Search engine

Information flow

Metadata Extractor

Collections

Content-based Value Filtering

- **Definition**
  - By static clues from documents or collections
- **Categories**
  - Document analysis
    - **analyze individual documents**
  - Collection analysis
    - **analyze entire collections**
  - Information context
    - **determine the context of documents**
  - Document-internal content tags
    - **manually place tags within documents**

Content-based Value Filtering

- **Document Analysis**
  - PHOAKS finds URLs from Usenet messages
    - **words surrounding URLs**
    - **URLs’ positions**
  - TileBar provides visual clues about locations
    - **support users in manually filtering query results**
  - Vocabulary complexity
    - **rate the reading level of documents for each user**
  - Genre of documents
    - **newspapers, journals, advertisements, interviews**
    - **certificated samples ⇒ patterns ⇒ predict genres**

Content-based Value Filtering

- **Collection Analysis**
  - Google crawls the Web for indexing
    - **prefer a document with more links pointing to it**
    - **by the authors' opinions**
  - SCAM finds mirrored documents of a website
    - **prefer such documents with survivability precautions or performance enhancements**
  - PHOAKS excludes the URLs in the messages posted to multiple news groups
    - **hint of advertisements**

Content-based Value Filtering

- **Information Context**
  - Publisher of documents
    - **New York Times, World Wide Web Consortium**
  - Time at which the document was published
    - **individual preferences ⇒ customized services**
  - ReferralWeb finds experts for consultations
    - **registrant ⇒ related individuals ⇒ a community**
    - **prefers documents that are connected with anyone in the user’s context**
  - Scatter/Gather and SONIA create contexts by interactively clustering documents
    - **manually control the filtering activities**

Content-based Value Filtering

- **Information Context (continued)**
  - SenseMaker combines controlled clustering with automated filtering
    - **criteria: author, publication date, website, …**
  - COATER determines the semantic contexts
    - **WordNet is a list of concepts with related words**
- **Document-internal Content Tags**
  - PICS has publishers add tags to documents
    - **prevent minors from inappropriate materials**
  - RDF allows complex schema to be built for websites
    - **a framework for using metatags**

Action-based Value Filtering

- **Definition**
  - By dynamic clues from human actions
- **Categories**
  - Explicit judgment
    - **relevance feedback for filtering**
    - **data-triggered filters**
    - **synthesized filters**
  - Implicit judgment
    - **conjecture from collective user behavior**
    - **conjecture from individual user behavior**

Action-based Value Filtering

- **Relevance Feedback for Filtering**
  - Tapestry allows users to annotate documents
    - **a collaborative filtering system**
    - **explicit judgments by more than a single user**
    - **the feedback itself is the grist for filtering**
      - ignore the contents (not content-based filtering)
  - Fab and GroupLens find out which users are best suited as sources of recommendation
    - **feedback ⇒ interest profiles ⇒ colleagues ⇒ recommendation by voting**

Action-based Value Filtering

- **Data-triggered Filters**
  - Mail filters allow users to discard messages
    - **manually construct filter expressions**
  - NetNanny eliminates undesirable data based on a list of words or phrases
    - **websites, news groups, chat rooms, …**
  - SIFT allows users to enter interest profiles
    - **Selective Dissemination of Information (SDI)**
- **Synthesized Filters**
  - LyricTime picks and plays songs for users
    - **mood indicators: cheerful, romantic, calm, sad, …**
    - **one profile per listener, per mood**

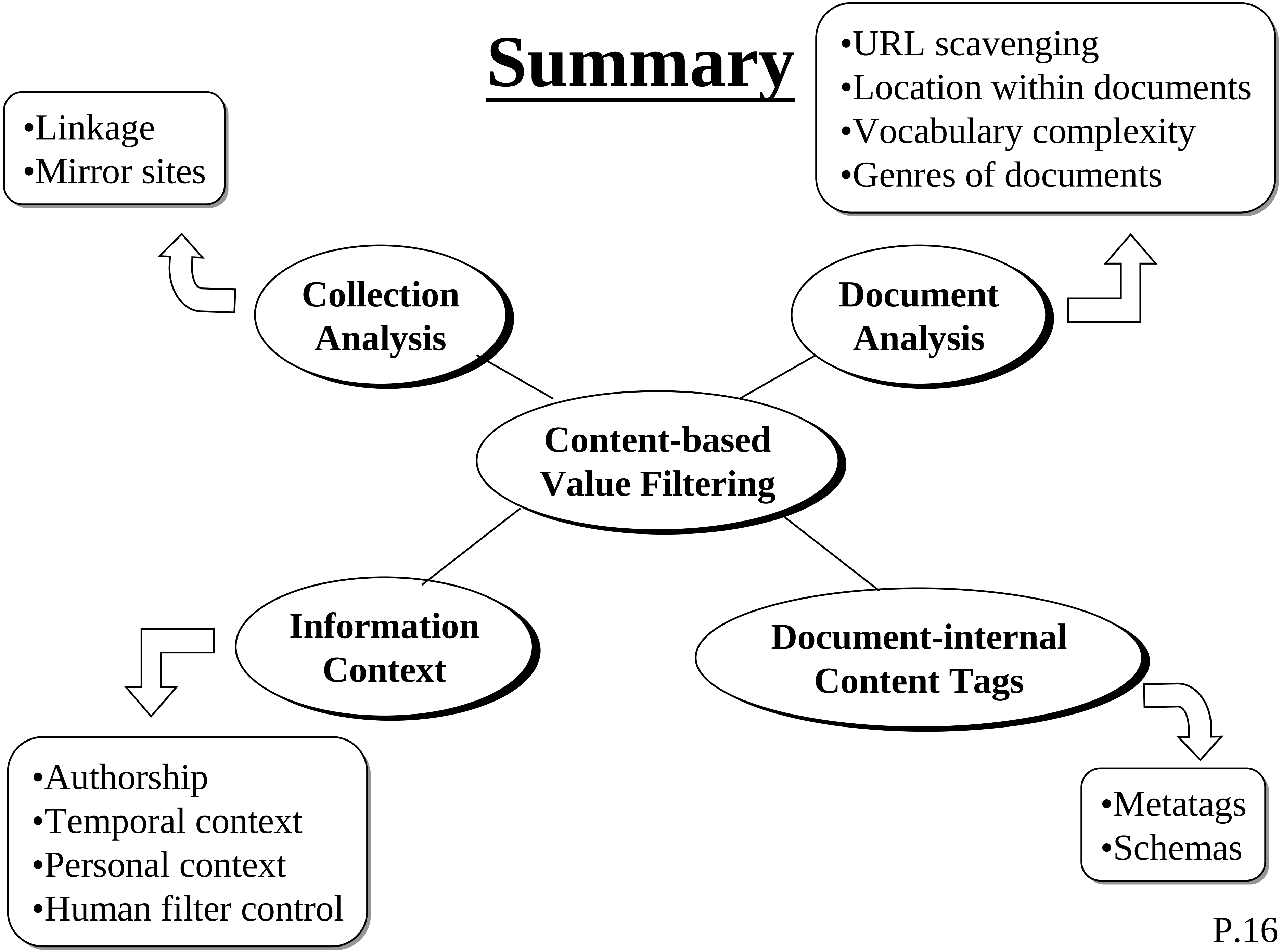
Action-based Value Filtering

- **Conjecture from Collective User Behavior**
  - WebWatcher supports guided tours
    - **correlations between links and user interests**
  - Path clustering ⇒ user/page clustering
    - **a path matched ⇒ hyperlink suggestions**
  - KSS annotates links by access frequencies
    - **served by a proxy**
  - HotBot and DirectHit collect the return rates of query results
    - **improve their ranking algorithms**

Action-based Value Filtering

- **Conjecture from Individual User Behavior**
  - HotBot and DirectHit
    - **record the keywords and collections associated with the returned results**
  - Predictors of user interests
    - **reading time**
    - **operations: save, bookmark, follow links, reply, …**
  - Siteseer aggregates personal bookmarks to support collective filtering
  - WebWatcher and Letizia evaluate the merits of links by matching keyword vectors

Summary



Content-based Value Filtering

Collection Analysis

- Linkage
- Mirror sites

Document Analysis

- URL scavenging
- Location within documents
- Vocabulary complexity
- Genres of documents

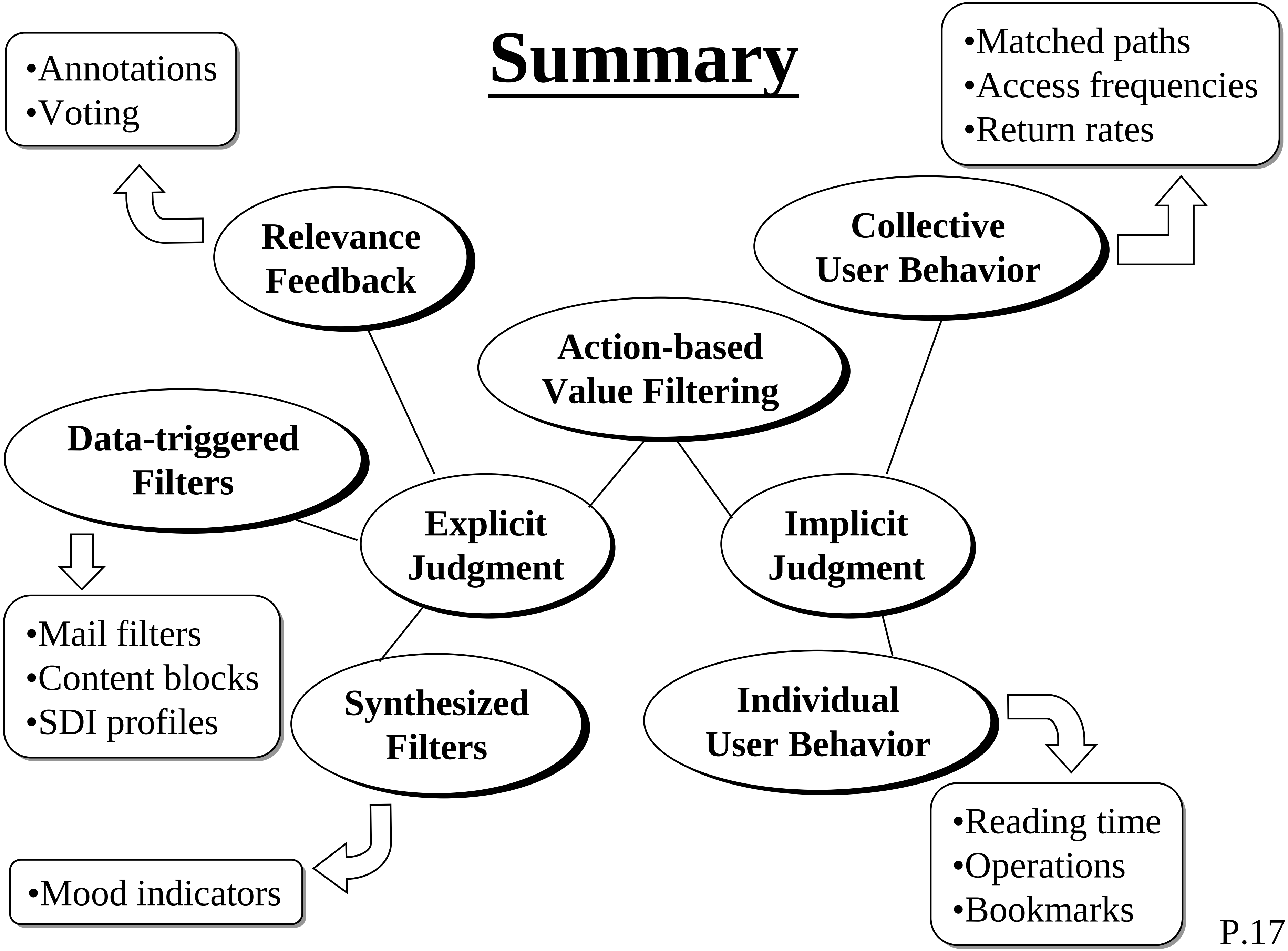
Information Context

- Authorship
- Temporal context
- Personal context
- Human filter control

Document-internal Content Tags

- Metatags
- Schemas

Summary



Explicit Judgment

Implicit Judgment

Action-based Value Filtering

Relevance Feedback

- Annotations
- Voting

Data-triggered Filters

- Mail filters
- Content blocks
- SDI profiles

Synthesized Filters

- Mood indicators

Collective User Behavior

- Matched paths
- Access frequencies
- Return rates

Individual User Behavior

- Reading time
- Operations
- Bookmarks

Summary

- **Contributions**
  - A conceptual architecture of value filtering
  - A survey and a categorization of techniques
- **Research Issues**
  - Side-effects of continuous positive feedback
  - Comparative filtering effectiveness
    - **logging, sampling, value decay, …**
- **Research Directions**
  - New types of collection and judgment metadata
  - User queries for information values