A Concept-Based Framework for Retrieving Evidence to Support Physician Decision Making at the Point of Care

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Premise and Issue

- **Premise**
  - Physicians should manage patients in the most effective way using the latest available clinical evidence regarding treatments and diagnosis

- **Issue**
  - How to provide the most relevant evidence in a concise manner at the point of care to support physician decision making
Successful Provision of Evidence

- Access to and provision of medical evidence must be integrated with existing clinical workflow

- Retrieved evidence must be contextually relevant for the current patient-physician interaction

- Evidence should be available where it is most often required - at the point of care
Challenges in Retriving Evidence

- Natural language processing/semantic understanding difficult for highly specialized medical corpuses

- Difficult to locate “most relevant” documents due to low precision of text-based search methodologies

- Ranked presentation style favored by many search engines not suitable for point of care support
Task and Proposed Solution

- **Task:**
  - Retrieve most relevant documents from the Cochrane Library and provide visualization that allows fast discrimination of relevant results

- **Solution:**
  - Employ a **logical concept-based query** mechanism, where concepts relate to specified disease and patient presentation
  - Combine concept-based query for document retrieval with **cluster-based approach** for document presentation
MET (Mobile Emergency Triage)

- Generic Clinical Decision Support System
- Current implementation is pediatric asthma
  - Provides Triage Recommendation for Asthma Severity
  - Supports Patient Management and Clinical Workflow
  - Multi-agent architecture to support complex care pathway
    - Clinical personnel, patient management tasks, hospital information systems
  - Point of care support
Agents Required for Retrieval of Evidence
Design of the Evidence-Based Agent

Retrieve most relevant patient-specific evidence and present at the point of care

Select relevant Cochrane database using CPGs

Construct concept-based query using disease terms (MeSH ontology) and patient terms (patient ontology)

Search Cochrane for evidence

Create clusters from query for document presentation

Process documents and assign to clusters for point of care display
EBA Planning Component

0. Retrieve Evidence for Point of Care Support

1. Construct Concept-Based Query
   - 1.1. Identify Correct Cochrane Library
   - 1.2. Formulate Query
     - severity treatment
     - disease concepts
     - patient concepts
   - 1.3. Retrieve, Store and Index Documents

2. Cluster Documents for Point of Care Presentation
   - 2.1. Create Clusters for Documents
     - severity treatment
   - 2.2. Assign Documents to Clusters
     - severity treatment
Planning an Evidence-Based Search I: Constructing a Concept-Based Query

- **Identify Appropriate Cochrane Database**
  - Compare values of patient attributes to asthma CPG lookup table

- **Formulate Concept-Based Search**
  - Instantiate disease and patient concepts with instances from MeSH ontology and underlying patient ontology respectively
  - Combine disease and patient concepts into text-based search using Boolean operators and specify Cochrane index to be searched
    

- **Retrieve documents and export to local database**
  - Index documents using standard text-based indexing engine
Planning an Evidence-Based Search II: Cluster Results for Presentation

- **Create Clusters for Retrieved Documents**
  - Formulate labeled clusters by automatically extracting instances of the patient ontology used in the concept-based query
    
    "severity", "treatment", "severity and treatment"

- **Assign Retrieved Documents to Correct Clusters**
  - Formulate queries by extracting attribute names and values from instances of the patient ontology used in the concept-based search
    
    "severity, moderate", "treatment, β-agonists",
    
    "severity, moderate, treatment, β-agonists"
  - Pass query strings to local text search engine and assign documents to relevant clusters based on discovery of queries in the documents
Conclusions and Future Work

- Concept-based framework for retrieving evidence
  - Integrated with asthma management workflow
  - Contextualizes evidence for current patient presentation
  - Clustering enhances precision and provides better visualization of information at the point of care

- Implementation and integration of the prototype agent underway using JADE environment

- Investigate Latent Semantic Indexing for enhanced retrieval of textual information

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