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**KHRESMOI**

**www.khresmoi.eu**

## Public annual report 2

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<b>Author(s)</b>	<i>Allan Hanbury</i>



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# 1 Khresmoi Annual Report



<http://khresmoi.eu>

The Khresmoi project addresses the challenges of searching through large amounts of radiology data, including Magnetic Resonance (MR) and Computed Tomography (CT), in hospital archives, as well as general medical information available on the internet. For the latter, it addresses the issues of trustworthiness and readability levels. The project consortium, consisting of 12 partners from 9 European countries, will develop a multilingual multimodal search and access system for biomedical information and documents. The system will allow text querying in several languages, in combination with image queries. It will return translated document summaries linked to the original documents. Khresmoi started on the 1st of September 2010 and runs for four years.

## 2 Summary of Activities

In the first year, Khresmoi has completed surveys of current search behaviour and desired improvements for all three target user groups: radiologists, physicians and members of the general public. Furthermore, it has developed first versions of the constituent components of the search system, and developed a framework for the integration of these components. An initial set of data on which the developed components and search system will be applied has been collected. This data includes a large 3TB collection of anonymised radiology images. Four early prototypes illustrating different aspects of the Khresmoi vision have been developed. These demonstrate: text search, machine translation, 2D radiology image and text search, and 3D radiology image search. The project is now positioned to develop the first prototype of the full search system by the end of the second year.

## 3 End User Surveys

Three surveys to elicit end user search practices and requirements were carried out. The first was an online survey aimed at members of the general public. The second survey was aimed at medical doctors, and was also performed online. A survey of the radiologists was done on a smaller scale, but included initial experiments on using eye tracking to determine the parts of an image that a radiologist concentrates on. The analysis of the results of these surveys will lead to the specification of the Khresmoi system requirements. The survey of the general public mostly represents the opinions of highly educated users occupied in areas of healthcare and IT. A total of 385 responses was collected. The survey of physicians received over 550 responses. From the radiologist survey, it became clear that image search is a common activity, often for finding interesting cases or articles for a differential diagnosis. Small regions of interest are usually most important for visual search.

## 4 Khresmoi Technologies

At the heart of the Khresmoi search engine will be a number of open source components, extended by the work done in Khresmoi. New components based on research results obtained in Khresmoi will also be included. Work on extending the existing components to meet the needs of the project began in year one. This included the setting up of a basic query expansion service for Mimir<sup>1</sup>, a search engine capable of indexing and searching over text, annotations, semantic schemas (ontologies), and semantic meta-data (instance data); as well as the development of a browser-based user interface and image display capabilities for ezDL<sup>2</sup>, a framework for interactive search applications. Furthermore, basic research has led to innovative techniques for anatomical structure identification and localisation, as well as visual-based anatomy retrieval and anomaly retrieval in 3D radiology images.

The first steps towards integrating the components that will make up the Khresmoi search engine were also taken this year. Four prototypes illustrating different aspects of the Khresmoi vision were developed, demonstrating: text search, machine translation, 2D radiology image and text search, and 3D radiology image search.

## 5 Data

A search engine is of little use if it does not access useful information. We have therefore paid attention to the information that will be indexed by the Khresmoi search engine. An initial knowledge base containing basic biomedical knowledge (Pubmed including UMLS, MeSH, LinkedCT, Pubmed, Drugbank, Geonames) has been set up. The information accessed by the initial prototypes includes the set of HONcode-certified websites (the HONcode is the certification of medical websites managed by the Health on the Net Foundation) and a subset of MEDLINE abstracts. The Cochrane Collaboration has also made available the complete text of their systematic reviews for use in Khresmoi.

For the radiology application, over three Terabytes of anonymised Computed Tomography (CT) and Magnetic Resonance (MR) images were obtained. Part of this data was manually annotated by anatomical location (e.g. head, chest, hand) and anomaly (e.g. bone density in osteoporosis). This data serves as a basis for semi-supervised learning in anatomy identification algorithms, as well as for anomaly retrieval.

## 6 User Involvement, Promotion and Awareness

In year 1, there were four main dissemination pushes, aiming to disseminate information about KHRESMOI to a large number of people:

- 1. Project start:** The KHRESMOI kick-off meeting in Vienna included a half-day general project presentation to which people from the scientific, business and medical communities external to the project were invited. Press releases were also sent out early in the project, leading to a large number of press articles. The first KHRESMOI Newsletter also covered this kick-off meeting.

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<sup>1</sup> <http://gate.ac.uk/family/mimir.html>

<sup>2</sup> <http://ezdl.de>

2. **General public survey:** The general public survey was promoted via patient organisations, banners on websites, social media and health-related newsletters.
3. **Physicians survey:** The physicians survey was promoted via newsletters and websites of medical societies and organisations.
4. **Events at the Medical Informatics Europe (MIE) 2011 Conference:** Khresmoi presentations took place in a workshop, three panels and scientific sessions. A workshop was organised by Khresmoi consortium members and a Khresmoi overview paper was presented.

Khresmoi has signed Memoranda of Understanding with two EU projects: PROMISE on the evaluation of search and CHORUS+ on multimodal search.

## 7 Future Work

The next major steps are to develop the specifications for the search system based on the results of the end user surveys, and integrate the components using the integration framework to produce the first full prototype search system by the end of the second year of the project. In parallel to this, further foundational research and component development will take place to improve the constituent components of the system so as to better satisfy the requirements of the end users. Finally, early prototypes now available will be used to demonstrate the potential of the envisioned Khresmoi system to end users and potential adopters, leading to the development of a more concrete exploitation plan for the project results.

## 8 Further Information

Kick-off meeting documentation:

<http://khresmoi.eu/resources/kick-off-meeting-documentation/>

Radiology eye tracking video:

<http://khresmoi.eu/news/radiology-eye-tracking-video-available/>