BioASQ

A challenge on large-scale biomedical semantic indexing and question answering

www.bioasq.org

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Intelligent Information Management
Targeted Competition Framework
ICT-2011.4.4(d)

What is BioASQ

► BIOASQ initiates a series of **challenges** on **biomedical semantic indexing** and **question answering (QA).**

► Participants will be required to index semantically content from **large-scale** biomedical sources (e.g., MEDLINE) and/or

► to assemble data from **multiple heterogeneous sources** (e.g., scientific articles, knowledge bases, databases)

► to compose **informative answers** to biomedical natural language questions.

Examples

Issue 1: Evaluate the safety and the effects of T3 treatment in patients with acute myocardial infarction.

Q1: What is the role of thyroid hormones administration in the treatment of heart failure?

Issue 2: Evaluate the effects of TNF blockade in opportunistic infection.

Q2: Does TNF blockade cause opportunistic infection?

Unfortunately, the questions cannot be submitted directly to current bibliographic databases ...

Example 1

Q1: What is the role of thyroid hormones administration in the treatment of heart failure

Identify related terms/concepts

heart failure, infarction, thyroid hormone treatment

Retrieve and select relevant snippets

Signaling Mechanisms in Thyroid Hormone-Induced Cardiac Hypertrophy

... possibility of their therapeutic utility in the treatment of the post-infarcted heart or in heart failure.

... Cardiac growth in response to thyroid hormones (L-thyroxine, T4 ...

…

[PMIDs: 20005976, 21860776]

Consolidate relevant snippets as answers

Cardiac growth may be a response to thyroid hormones. Thus, administration of thyroid hormones may be useful in the treatment of heart failure. Subclinical hypothyroidism may be a cause of heart failure.

Example 2

Q2: Does TNF blockade cause opportunistic infection?

Identify related terms/concepts

> TNF blockade, anti-tumor therapy, opportunistic infection

Retrieve and select relevant snippets

> Opportunistic infections, especially reactivation with M. tuberculosis, are major complications during treatment with anti-TNF agents ...
>
> Neutralization of TNF causes a decrease in the inflammatory response but increases susceptibility to opportunistic infections such as fungal infections ...
>
> ... association of anti-tumor necrosis factor therapy with opportunistic infections in rheumatoid arthritis (RA) patients has been reported ...
>
> ... all anti-TNF agents have been associated with a variety of serious and "routine" opportunistic infections, particularly tuberculosis ...
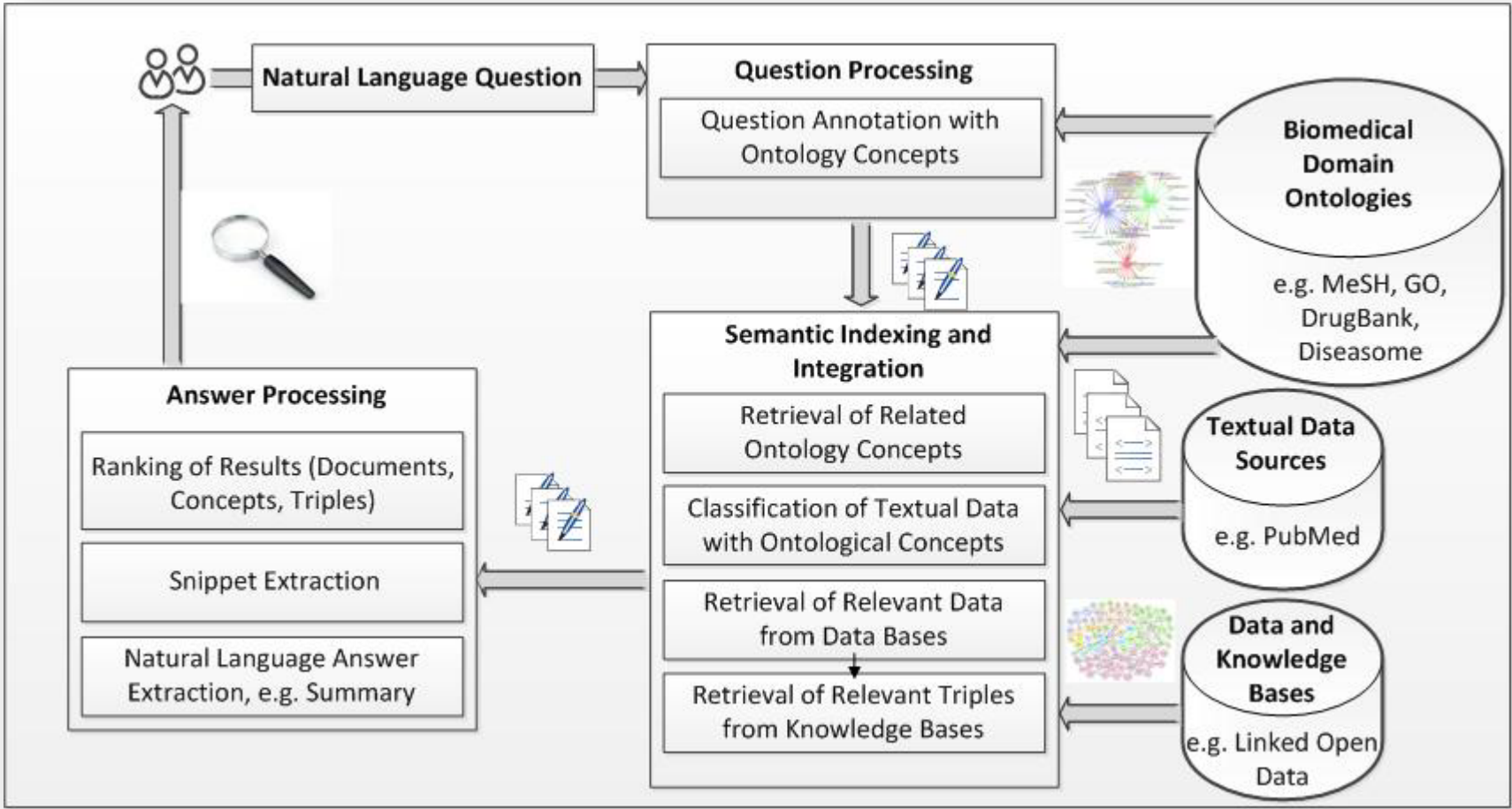>
> …
>
> [PMIDs: 22770648, 22398055, 22354637, 22311162]

Consolidate relevant snippets as answers

> TNF neutralization and anti-TNF agents have been reported to be associated with opportunistic infections, particularly tuberculosis.

Biomedical semantic indexing and QA

Challenge Objectives

The **challenge (aka competition or shared task)** will assess:

1. **large-scale classification of biomedical documents** onto ontology concepts (semantic indexing),
2. **classification of biomedical questions** onto relevant concepts,
3. **retrieval** of relevant document snippets, concepts and knowledge base triples,
4. **delivery** of the retrieved information in a concise and **user-understandable form**.

The challenge

Imaginary participant: MedAnswers Inc.

Task 1a: **Large-scale online biomedical semantic indexing**

► BioASQ distributes new unclassified PubMed documents

► MedAnswers attaches MeSH terms

Evaluation when abstracts get classified by PubMed curators.

The challenge

Natural Language Question

Question Processing

Question Annotation with Ontology Concepts

Biomedical Domain Ontologies

e.g. MeSH, GO, DrugBank, Diseasome

Semantic Indexing and Integration

Retrieval of Related Ontology Concepts

Classification of Textual Data with Ontological Concepts

Retrieval of Relevant Data from Data Bases

Retrieval of Relevant Triples from Knowledge Bases

Textual Data Sources

e.g. PubMed

Data and Knowledge Bases

e.g. Linked Open Data

Answer Processing

Ranking of Results (Documents, Concepts, Triples)

Snippet Extraction

Natural Language Answer Extraction, e.g. Summary

The challenge

Imaginary participant: MedAnswers Inc.

Task 1b: Introductory biomedical semantic QA
Stage A:
► BioASQ distributes questions from benchmark
► MedAnswers responds with concepts, snippets, triples
Stage B:
► BioASQ distributes questions + concepts, snippets, triples
► MedAnswers responds with exact answers or summaries
Evaluation with gold answers, majority and manually (sample)

The challenge

Task 1b

BioA?Q
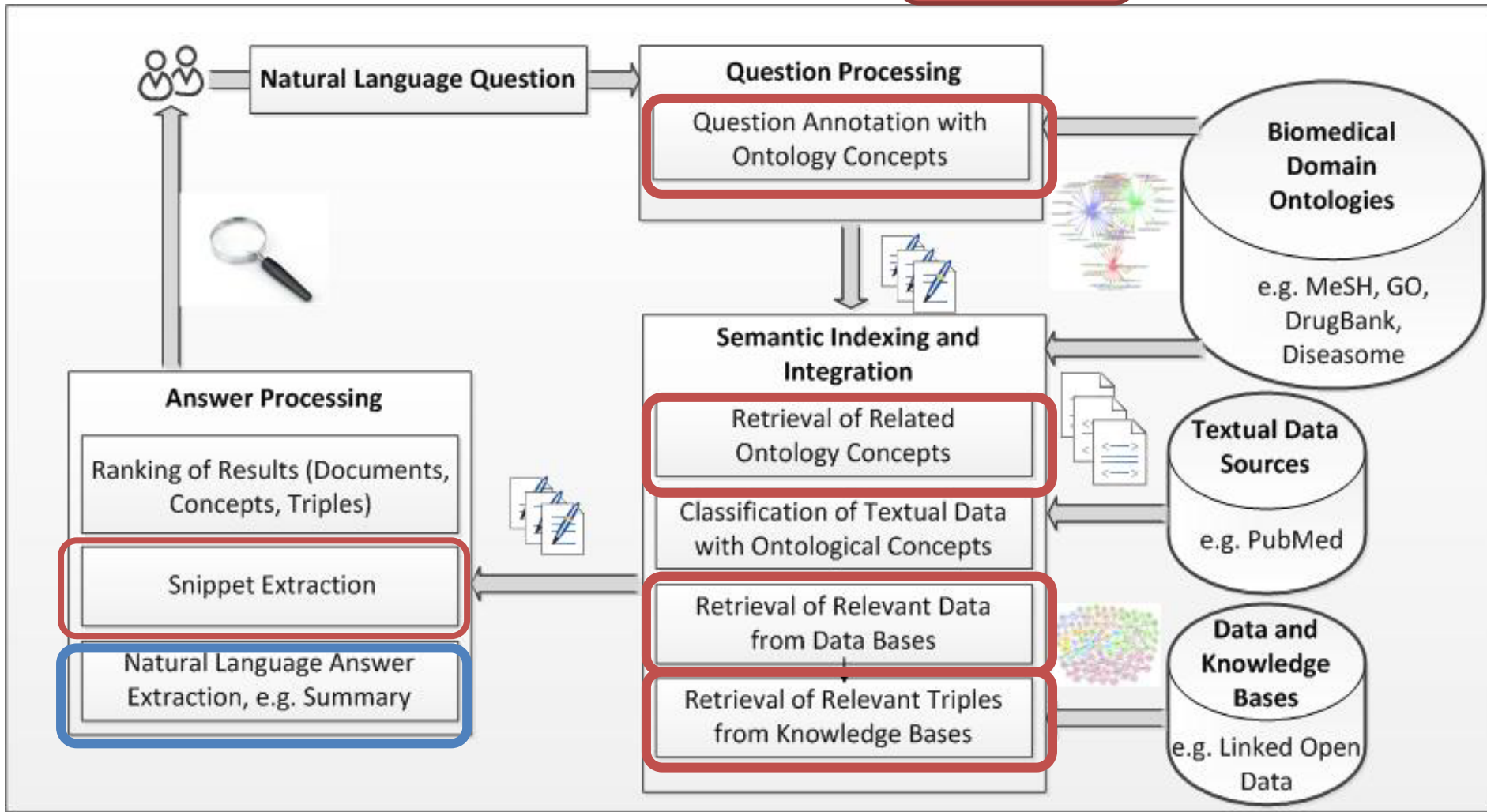
The Challenge

Task 2a: same as 1a, with new data and improvements

Task 2b: (similar to 1b, but only one stage)

► BioASQ distributes questions from new benchmark

► MedAnswers responds with concepts, snippets, triples, exact answers or summaries, etc.

Evaluation with gold answers, majority and manually (sample)

Evaluation Measures

▶ **Task 1a**: **Large-scale online biomedical semantic indexing**

   ▶ Precision, Recall, F-Measure and hierarchical variants

▶ **Task 1b: Introductory biomedical semantic QA**

  Stage A (concepts, snippets, triples)*:*

   ▶ Precision, Recall, F-Measure

  Stage B:

   ▶ Exact answers: Accuracy, MRR, similarity to majority

   ▶ Summaries: ROUGE or similar, similarity to centroid

Each type of response evaluated separately.

Participation can be partial.

Challenge Data – QA Benchmarks

- **Sources**:
  - PubMed Central articles
  - Biomedical knowledge bases (e.g. *MeSH/UMLS, Jochem, SwissProt, Diseasesome*).

- **Volume**: Minimum 300 questions per challenge, plus relevant concepts, triples and snippets, gold answers.

- **Produced by**: a team of biomedical experts, using a specialized annotation tool.

- **Sustainability**: BioASQ social network to support new benchmarks and evaluation campaigns. Annotation tool freely available with the social network.

Annotation tool - mockup

Social Network

OntoWiki-DSSN as basis

- ► Distributed Semantic Social Network built upon OntoWiki components
  - ► concrete implementation of DSSN on top of OntoWiki
- ► Resource-centric
  - ► Questions and answers modeled as resources
  - ► Editing, discussion, subscription (i.e. follow a resource), change management
- ► Custom user interface for domain experts
  - ► hide technical details of RDF
- ► Distributed for scalability

Participation

- ► **Diverse and multi-disciplinary target**: bioinformatics, medical informatics, information retrieval, machine learning, natural language processing, text mining.

- ► **Academia and industry** (interest expressed by Microsoft Research, Yahoo!, Xerox and others).

- ► **Simultaneous transmission** of questions – **time-limits** on answers.

- ► Easy submission of results through **Web services**.

- ► Large **hardware infrastructure** (a cluster of ~5000 cores) available for those who want to use it.

- ► **Prizes** to the best performing systems per task.

- ► Outstanding methods will be presented in a **special issue**.

Draft Schedule - 1st Challenge

▶ March 2013: Evaluation infrastructure and dry-run data available for testing.

▶ June 2013: Start of the challenge.

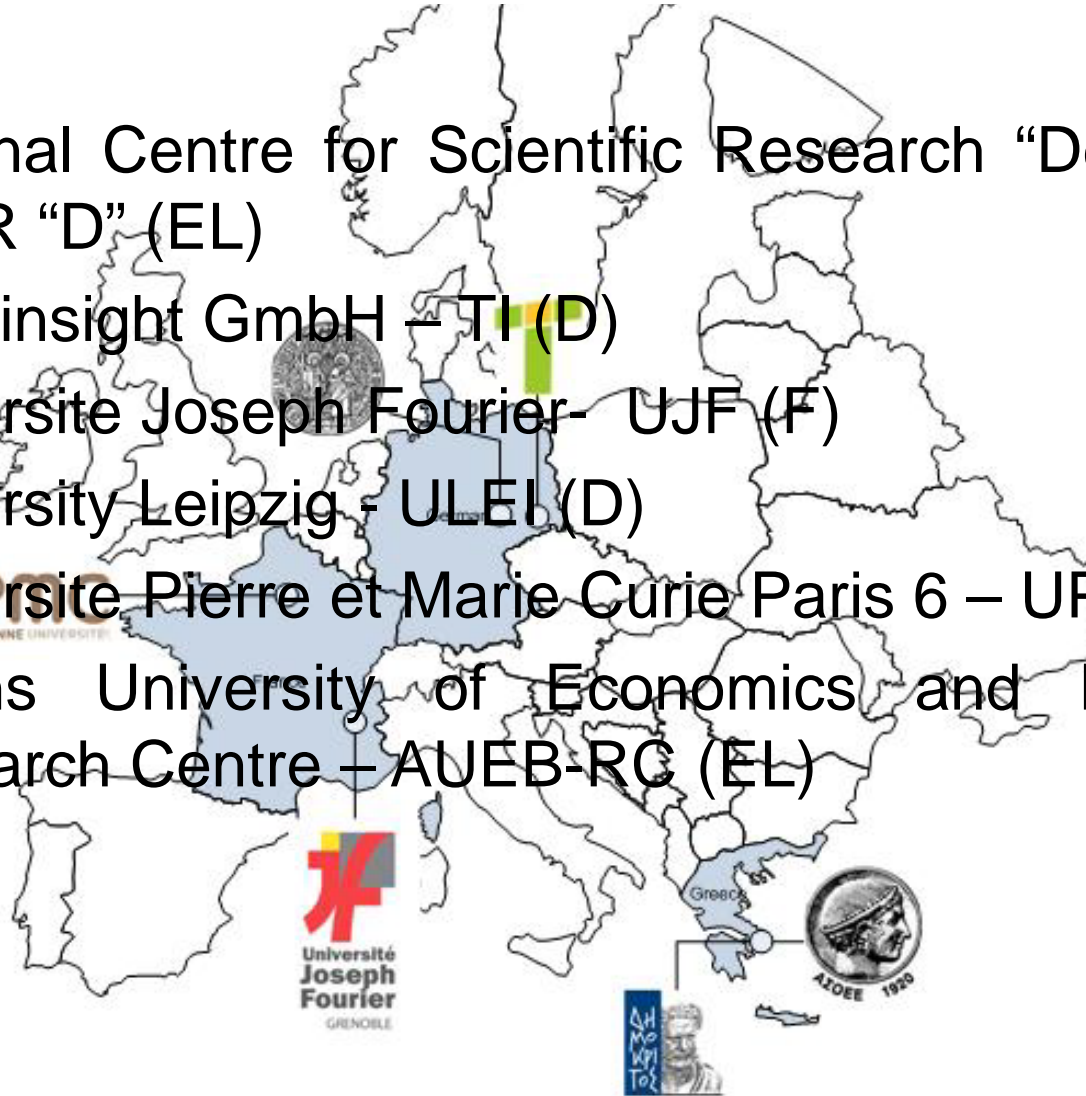▶ August 2013: End of the challenge.

▶ September 2013: BioASQ workshop.

Evaluation infrastructure & dry-run data	Start of the challenge	End of the challenge	BioASQ workshop
March 2013	June 2013	August 2013	September 2013
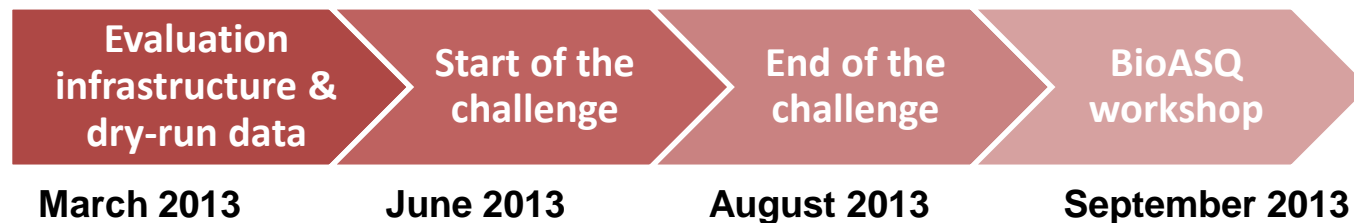
BioASQ Project

► BioASQ challenge series will be organized by the BioASQ project.

► Funded by the European Commission, under FP7 ICT-2011.4.4 Intelligent Information Management.

► Start: October 1, 2012 – End: September 30, 2014

► Budget: 1.27 MEuro

Project Consortium

1. National Centre for Scientific Research "Demokritos" - NSCR "D" (EL)
2. Transinsight GmbH – TI (D)
3. Universite Joseph Fourier- UJF (F)
4. University Leipzig - ULEI (D)
5. Universite Pierre et Marie Curie Paris 6 – UPMC (F)
6. Athens University of Economics and Business – Research Centre – AUEB-RC (EL)

Thank you!

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Evaluation infrastructure & dry-run data	Start of the challenge	End of the challenge	BioASQ workshop
March 2013	**June 2013**	**August 2013**	**September 2013**