

# Evaluation Protocol and Tools for Question-Answering on Speech Transcripts

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## Abstract

Question Answering (QA) technology aims at providing relevant answers to natural language questions. Most Question Answering research has focused on mining document collections containing written texts to answer written questions. In addition to written sources, a large (and growing) amount of potentially interesting information appears in spoken documents, such as broadcast news, speeches, seminars, meetings or telephone conversations. The QAST track (Question-Answering on Speech Transcripts) was introduced in CLEF to investigate the problem of question answering in such audio documents. This paper describes in detail the evaluation protocol and tools designed and developed for the CLEF-QAST evaluation campaigns that have taken place between 2007 and 2009. We first remind the data, question sets, and submission procedures that were produced or set up during these three campaigns. As for the evaluation procedure, the interface that was developed to ease the assessors' work is described. In addition, this paper introduces a methodology for a semi-automatic evaluation of QAST systems based on time slot comparisons. Finally, the QAST Evaluation Package 2007-2009 resulting from these evaluation campaigns is also introduced.

## 1. Introduction

Question Answering (QA) technology aims at providing relevant answers to natural language questions. Most Question Answering research has focused on mining document collections containing written texts to answer written questions [1]. In addition to written sources, a large (and growing) amount of potentially interesting information appears in spoken documents, such as broadcast news, speeches, seminars, meetings or telephone conversations. The QAST track (Question-Answering on Speech Transcripts) was introduced in CLEF to investigate the problem of question answering in such audio documents.

This paper describes in detail the evaluation protocol and tools that were developed for the CLEF-QAST evaluation campaigns that have taken place in 2007 [2], 2008 [3] and 2009 [4]. The QAST Evaluation Package 2007-2009 resulting from these evaluation campaigns is also introduced.

## 2. Evaluation Data and Tasks

### 2.1. Data Collections

Along the years, participants to QAST campaigns were proposed different evaluation scenarios and tasks, each one involving a different data set:

- (1) CHIL corpus: lectures in English on topics related to "speech and language processing",
- (2) AMI corpus: meetings in English about "design of television remote control",
- (3) ESTER corpus: French broadcast news,
- (4) EPPS-EN corpus: European Parliament debates in English,
- (5) EPPS-ES corpus: European Parliament debates in Spanish.

For each corpus two types of transcriptions were available and had to be processed:

- *Manual Transcriptions*: the exact manual transcriptions (including speech disfluencies) of the original audio documents were done at ELDA<sup>1</sup>.
- *Automatic (or ASR) Transcriptions*: automatic transcriptions of the data sets were also available. They were produced by multiple automatic speech recognition (ASR) engines that have been developed in the context of European and national projects: the CHIL project [5][6] for corpus (1), the AMI project [7] for corpus (2), the ESTER project [8] for corpus (3), and the TC-STAR project [9] for (4) and (5).

Table 1 gives more details on the evaluation corpora used in QAST from 2007 to 2009.

Corpus	Lang.	Description	Transcripts	WER	Campaigns
CHIL	EN	25 lectures (~25h)	manual	-	2007, 2008
			1 set ASR	20%	2007, 2008
AMI	EN	168 meetings (~100h)	manual	-	2007, 2008
			1 set ASR	38%	2007, 2008
ESTER	FR	18 BN shows (~10h)	manual	-	2008, 2009
			3 sets ASR	A: 11.9% B: 23.9% C: 35.4%	2008, 2009
EPPS	EN	6 sessions (~3h)	manual	-	2008, 2009
			3 sets ASR	A: 10.6% B: 14.0% C: 24.1%	2008, 2009
EPPS	ES	6 sessions (~3h)	manual	-	2008, 2009
			3 sets ASR	A: 11.5% B: 12.7% C: 13.7%	2008, 2009

Table 1. QAST evaluation data sets, with word error rates (WER) of automatic transcription corpora (ASR).

<sup>1</sup>ELDA: <http://www.elda.org>

## 2.2. Question Sets

Each year, 2 new sets of questions were created from each evaluation corpus:

- Development set: 50 questions,
- Test set: 100 questions.

In 2007, only factual questions were created, based on 10 types of named entities: person, location, organization, language, system, measure, time, color, shape, material.

In 2008, definition questions were introduced (around 75% factual and 25% definition questions in each set) based on 4 types: person, organization, object, other.

In 2009, the same types of questions were used, but a new question collection protocol was designed. In the previous years, written questions were created by hand from each corpus by a single reader. In 2009, spontaneous oral questions were recorded by several speakers just after they had read pieces of texts extracted from the corpora [10]. Oral questions were transcribed (including speech disfluencies). A clean written version of these transcripts was produced afterwards, resulting in two types of questions for each set:

- Spontaneous oral questions (i.e. their transcripts)
- Plus their “canonical” written equivalents.

Example of transcription of a 2009 spontaneous oral question:

*When did the bombing of Fallujah t() take took place?*

and its written equivalent:

*When did the bombing of Fallujah take place?*

## 2.3. Evaluation Tasks

Based on these data and question sets, different evaluation tasks were proposed each year to the participants:

- QA on the manual transcription of each evaluation corpus,
- QA on the different sets of ASR transcriptions assigned to each evaluation corpus.

In 2009, participants could use spontaneous oral questions (in addition to written questions) to test their QA system both on manual and ASR transcriptions.

## 3. Submission

### 3.1 Submission Procedure

Each year, QAST participants were first sent the training dataset (texts and questions) prior to the start of the evaluation, in order to train their systems with the required question types. Then, as soon as the evaluation campaign was started, they received test collections and question sets. They had one week to return their QA systems’ answers to the evaluation agency (ELDA).

### 3.2 Submission Format

The required answer format was basically structured as an

[*answer-string*, *document-id*] pair, where the *answer-string* contains nothing more than a complete and exact answer and the *document-id* is the unique identifier of a document that supports the answer.

There were no particular restrictions on the length of an answer string, but participants were aware that unnecessary pieces of information would be penalized with the answer being assessed as “*inexact*”.

A run had to be submitted as a single text file containing one line per answer, with the following format:

```
<question-id>      <run-id>      <document-id>
<answer-string> <ranking> <score> <starttime>
<endtime>
```

where:

- *<question-id>* is the question identification number,
- *<run-id>* identifies the submitted run (participant, sub-task),
- *<document-id>* contains the name of the document where the answer was found (or a blank if no answer was found),
- *<answer-string>* contains the answer-string (or ‘*NIL*’ if no answer was found),
- *<ranking>* is the answer’s rank (it was possible to submit up to 5 answers to a same question),
- *<score>* (or confidence score) is a mandatory score-value per answer,
- *<starttime>* and *<endtime>* are mandatory only if automatic transcripts are used and give the position of the answer in the signal (extracted from the ASR transcription files).

Examples:

Questions:

```
...
38 Which university is located in Dallas?
39 What language has the most important economic
impact?
...
```

Answers in manual transcriptions

```
...
38 limsil_t1a ISL_20050112 southern methodist
university 1 0.76
38 limsil_t1a NIL 2 0.68
39 limsil_t1a ISL_20050420 english 1 0.52
39 limsil_t1a ISL_20050420 english 2 0.50
39 limsil_t1a ISL_20050112 dutch 3 0.42
...
```

Answers in automatic transcriptions

```
...
38 limsil_t1b ISL_20050420 Southern at the
University 1 0.76 94.340 95.310
38 limsil_t1b NIL 2 0.68
39 limsil_t1b ISL_20050420 English 1 0.52 551.800
552.120
39 limsil_t1b ISL_20050420 English 2 0.50 1263.920
```



- Each found answer was manually labelled with its actual timestamps in the audio signal (start time and end time).

Then, after the participants had submitted their runs, the assessment procedure consisted in two steps:

- Submitted files were assessed with an automatic script which compared the time slots of submitted answers to the time slots of reference.
- The automatic assessments were finally checked by hand by a human assessor using the QASTLE interface.

In the first pass, a submitted answer is assessed via a script by comparing its hypothesis time slot  $[TH_{start}; TH_{end}]$  to the time slots of reference  $[TR_{start}; TR_{end}]$  (there can be several reference slots, since correct answers may appear in different parts of the corpus). The decision procedure implemented in the assessment script is the following:

- If a sufficient overlap is observed between a submitted answer and one of the answers of reference, this answer is tagged as correct. In other words, if there is at least one reference answer  $[TR_{start}; TR_{end}]$  for which:

$$TR_{start} - \Delta T \leq TH_{start} \leq TR_{start} + \Delta T$$

$$\text{AND } TR_{end} - \Delta T \leq TH_{end} \leq TR_{end} + \Delta T$$

then the answer contained in  $[TH_{start}; TH_{end}]$  is set to *R* (correct).

- Else, if there is at least one reference answer  $[TR_{start}; TR_{end}]$  that overlaps the hypothesis time slot  $[TH_{start}; TH_{end}]$ , then the answer contained in  $[TH_{start}; TH_{end}]$  is set to *X* (inexact).
- Else, the answer contained in  $[TH_{start}; TH_{end}]$  is set to *W* (wrong).

The overlap threshold (defined by the delta value  $\Delta T$ ) is derived from word-length statistics. A specific delta value  $\Delta T$  has been computed beforehand for each of the transcription sets by taking the 95th percentile value in each case. These values are given in Table 2:

ASR Transcripts	WER	$\Delta T$
CHIL	20.0%	610 ms
AMI	38.0%	630 ms
ESTER – A	11.9%	600 ms
ESTER – B	23.9%	630 ms
ESTER – C	35.4%	640 ms
EPPS-EN – A	10.6%	700 ms
EPPS-EN – B	14.0%	680 ms
EPPS-EN – C	24.1%	750 ms
EPPS-ES – A	11.5%	720 ms
EPPS-ES – B	12.7%	700 ms
EPPS-ES – C	13.7%	760 ms

Table 2. Delta values of the transcription sets.

In the second pass (manual checking of automatic assessments), a human assessor had to ensure that each ‘correct’ (R) or ‘inexact’ (X) answer could be found in the associated document: if not, it was retagged as

‘unsupported’ (U). When an answer tagged as ‘wrong’ (W) or ‘inexact’ (X) was re-assessed as ‘correct’ by the assessor, the corresponding time slot was manually adjusted or added in the reference and all runs were reassessed according to the new updated list of reference answers.

### 4.3 Results

Table 3 gives a very short overview of the results obtained in the three past QAST campaigns (the best accuracy score is given in each case). For QAST 2009 two columns of results are given: the right ones result from using ‘oral’ questions (i.e. exact transcriptions of spontaneous oral questions), the left one result from using ‘written’ questions (i.e. their canonical form).

Corpus	Transcr.	Acc. 2007	Acc. 2008	Acc 2009 Written	Acc. 2009 Oral
CHIL	Manual	0.51	0.41	-	-
	ASR	0.36	0.31	-	-
AMI	Manual	0.25	0.33	-	-
	ASR	0.21	0.18	-	-
ESTER	Manual	-	0.45	0.28	0.26
	ASR (A)	-	0.41	0.26	0.25
	ASR (B)	-	0.25	0.21	0.21
	ASR (C)	-	0.21	0.21	0.20
EPPS-EN	Manual	-	0.34	0.36	0.36
	ASR (A)	-	0.30	0.27	0.26
	ASR (B)	-	0.20	0.25	0.25
	ASR (C)	-	0.19	0.23	0.24
EPPS-ES	Manual	-	0.31	0.28	0.28
	ASR (A)	-	0.24	0.29	0.29
	ASR (B)	-	0.20	0.27	0.25
	ASR (C)	-	0.23	0.23	0.22

Table 3. Overview of past QAST results (best accuracy scores).

Generally speaking, a loss in accuracy is observed when dealing with automatic transcriptions instead of manual transcriptions. This difference is larger for tasks where the ASR word error rate is higher. Another observation concerns the loss of accuracy when dealing with different word error rates. Generally speaking, higher WER results in lower accuracy. Nonetheless, the results indicate that if a QA system performs well on manual transcriptions it also performs reasonably well on high quality automatic transcriptions.

The 2008 data sets were re-used in QAST 2009, where a new question creation method has been set up to generate spontaneous spoken questions. The overall absolute results were worse compared to 2008; which points to a globally harder task. The question development method produces requests which qualitatively seem to be more different to what is found in the documents compared to questions built after reading the documents (as in 2007 and 2008). In our opinion, that method, while leading to a harder problem, puts the task closer to a real, usable application.

The detailed results of the QAST campaigns can be found in the working notes of the CLEF 2007 [2], CLEF 2008 [3] and CLEF 2009 [4] workshops.

## 5. Evaluation Package

The QAST evaluation data and tools will be made publicly available to the research community as part of the “QAST 2007-2009 Evaluation Package” which will be distributed by ELDA through the ELRA catalogue<sup>3</sup>.

The complete evaluation package contains all the necessary resources to enable any developer to benchmark his systems and compare results to those obtained during the official evaluation. The QAST Evaluation Package consists of the following:

- Description of the content of the package, and of the QAST evaluations (tasks, data, metrics, etc.),
- All data sets (corpora and question sets),
- Participants' submissions and results,
- Scoring tools.

The QAST Evaluation Package will be released as part of the CLEF Evaluation Packages published in 2010.

## 6. Conclusion

This paper has given an overview of the evaluation protocol and tools that were developed for the CLEF-QAST evaluation campaigns. In particular, it introduces a methodology for a semi-automatic evaluation of QAST systems based on time slot comparisons. These tools and methods will be further developed in next QAST evaluation campaigns.

The QAST 2007-2009 evaluation package is publicly available to the community through the ELDA Catalog. Its goal is to enable external players to benchmark their system and compare their results with those obtained during the official evaluation campaign. It will be distributed through the ELRA catalogue.

## 7. Acknowledgements

This work has been partially supported by the European project Treble-CLEF (ICT-1-4-1 215231).

The work of UPC (Universitat Politècnica de Catalunya) as coordinator of the QAST tracks was partially supported by the KNOW2 project (TIN2009-14715-C04-04).

The work of LIMSI (Laboratoire d'Informatique pour la Mécanique et les Sciences de l'Ingénieur) as co-organizer of the QAST tracks has been partially financed by OSEO under the Quaero program.

The work of UPV (Universitat Politècnica de València) as co-organizer of the QAST 2009 track was partially supported by the TEXTENTERPRISE 2.0 project (TIN2009-13391-C04-03).

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<sup>3</sup> ELRA Catalogue of Language Resources:  
<http://catalog.elra.info/>