

QuARS Express - A Tool Demonstration

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Abstract

Requirements analysis is an important phase in a software project. Automatic evaluation of Natural Language (NL) requirements documents has been proposed as a means to improve the quality of the system under development. QUARS EXPRESS is an automatic analyzer of Natural Language (NL) requirements able to manage complex and structured requirement documents containing metadata, and to produce an analysis report rich of informations that points out linguistic defects and indications about the writing style of NL requirements. This tool demonstration paper introduces the ideas behind QUARS EXPRESS.

1 QUARS EXPRESS

QUARS EXPRESS presents a GUI that allows the user to perform the time-consuming analysis in a click. Figure 1 presents it with respective elements. The main features of this tool are described in the following list:

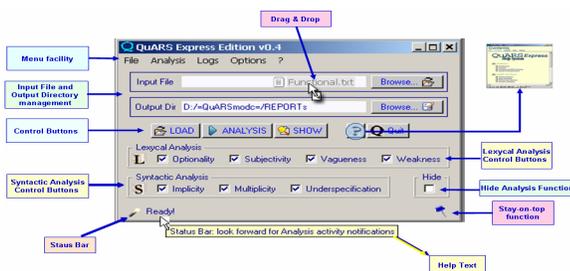


Figure 1. QUARS EXPRESS Graphical User Interface

- **Defect Identification.** The analysis performed by QUARS EXPRESS can be divided in lexical analysis, capturing *optionality*, *subjectivity*, *vagueness* and *weakness* defects, and syntactic analysis, capturing *implicitly*, *multiplicity* and *under-specification* defects, as well.

- **Readability Analysis.** In QUARS EXPRESS, seven readability indexes have been introduced. This new feature exploits the GNU program called "Diction/Style" [1]. The Style program analyzes the surface characteristics of the writing style of a document and calculates the values of seven readability indexes well known in the readability research field: *Kincaid*[6], *ARI* [2], *Coleman-Liau*[4], *Flesh*[5], *FOG*[7], *LIX*[8], *SMOG*[3].

These readability indexes are a mathematical attempt, based on word and syllable count, to point out the minimum US school grade the reader needs to understand the text. As a consequence, there is not an actually *good* value for any of them, but we can assume that technical writings, as requirements documents are, present an unavoidable reading difficulty that leads to scores higher than those presented by common popular writings such as newspapers, novels etc. The readability analysis scores are shown in each report file for each defective sentence such as the lexical analysis and the syntactic analysis.

- **Metrics and Statistics derivation.** The set of metrics has been enriched with the *analysis defect rate* and *error defect rate*, explained in detail in the following.

- *Defect Rate.* It is the percentage ratio between the number of requirements with at least a defect and the total number of analyzed requirements. Moreover, the same ratio is calculated

with respect to requirements subsets catalogued by metadata fields.

- *Analysis Defect Rate.* It is the percentage ratio between the number of requirements with at least a defect of a chosen type (*Optionality, Subjectivity, Vagueness, Weakness, Implicity, Multiplicity, Underspecification*), divided by the number of defective requirements found in the document. The same ratio is calculated with respect to requirements subsets belonging to metadata fields as well.
- *Error Defect Rate.* Since more defects can be found in a single requirement, this finer metric gives the percentage ratio of defects of the chosen type and the total number of defects found.

Note that all the defect rates are calculated with respect to both general analysis results, and to any single chosen kind of analysis.

1.1 QUARS EXPRESS Input

Since QUARS EXPRESS is interfaced with a repository based on RequisitePro [9] this has required the definition of a text format of each requirement that has been established to handle the five metadata fields: a requirement unique *ID*, the *Responsibility*, the *Type*, the *Source*, and the *Package*. Any requirement is traceable by means of at least one of its five metadata fields and the produced report is tailored to be used both for analysis and correction purposes, or for productiveness investigations. The text format is illustrated in Figure 2 with an example;

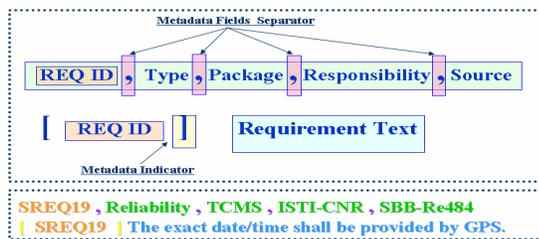


Figure 2. QUARS EXPRESS Input Data Format with an example

1.2 QUARS EXPRESS Output

QUARS EXPRESS produces an analysis report rich of categorized information. The information grows as a function of the number of metadata items available (e.g. as a function of the number of authors, the number of packages

and so on) and the size of the report grows consequently and can be made of several pages.

The general report files show the analysis performed on the whole document and give a general idea of the defects distribution showing concise overview tables and global statistics.

| Analysis Statistics | | | | | | |
|--|------------------------|--------------|--------------|-----------|--------------|--------------------|
| Analyzed Requirements | Defective Requirements | Errors | Defect Rate* | | | |
| 793 | 292 | 573 | 37% | | | |
| * The number of sentences found in the document with at least an error (defective sentences) divided by the number of the analyzed sentences (e.g. all the requirements found in the document) | | | | | | |
| Analysis --> | | Defect Rates | | | | |
| Optionality | Subjectivity | Vagueness | Weakness | Implicity | Multiplicity | Underspecification |
| 19% | 1% | 1% | 1% | 3% | 25% | 3% |
| 1% (5/793) | 1% (8/793) | (106/292) | (11/292) | (24/292) | (158/292) | 3% (21/793) |
| Error Defect Rate*** | | 22% | 2% | 5% | 65% | 4% |
| 1% (5/573) | | 1% (8/573) | (124/573) | (14/573) | (29/573) | (372/573) |
| ** The number of sentences with at least an error of the kind of the analysis related item (Optionality, Subjectivity,...) divided by the number of defective sentences found in the document | | | | | | |
| *** The number of related analysis item errors divided by the total number of errors found in the document | | | | | | |

Figure 3. QUARS EXPRESS Output

References

- [1] Diction/Style reference site. See: <http://www.gnu.org/software/diction>
- [2] E. A. Smith, R. J. Senter. *Automated Readability Index (ARI)* Wright-Patterson AFB, OH: Aerospace Medical Division. AMRL-TR, 66-22, 1967.
- [3] H. McLaughlin. *SMOG grading - a new readability formula*, Journal of Reading, 22, 639-646, 1969.
- [4] M. Coleman and T.L. Liau. *A Computer readability formula designed for machine scoring*, Journal of Application Psychology, 60, 283-284, 1975.
- [5] R. Flesch. *How to Write Plain English*, HarperCollins - 1st edition (August 1979)
- [6] J. P. Kincaid, R. P. Fishburne, R. L. Rogers and B. S. Chissom. *Derivation of new readability formulas for navy enlisted personnel.* (1975).
- [7] R. Gunning. *The Technique of Clear Writing*. McGraw-Hill New York, 1952
- [8] J. Anderson. *Analysing the Readability of English and Non-English Texts in the Classroom with Lix* Paper presented at the Australian Reading Association Conference, Darwin, August (ED 207 022).
- [9] IBM Rational RequisitePro. <http://www-306.ibm.com/software/awdtools/reqpro/>.