SFU Q/A Summary Handler (SQuASH) for DUC-2006

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Our Approach
(similar to DUC-2005)

1) Annotate:
   - Perform syntactic and semantic analysis
2) Extract:
   - Content selection
   - Optimization on DUC05 data
3) Edit:
   - Improve the linguistic quality of summary

Annotation Components

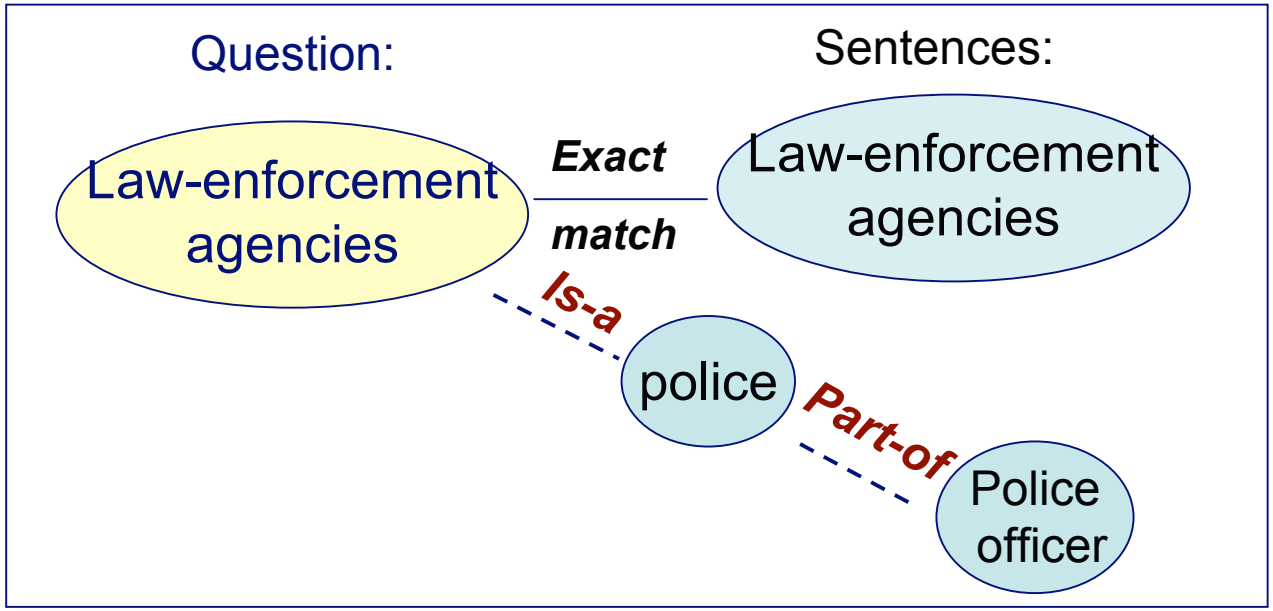
- **Syntactic Annotation**
  - Sentence Boundary Detection and Tokenization (Lingpipe)
  - Part of Speech Tagging
  - Parsing (Charniak)

- **Semantic Annotation**
  - Named Entity Recognition (Lingpipe)
  - WordNet Relation Identification (WordNet)
  - Semantic Role Labeling (Assert)

WordNet Relation

- Motivation
  - Better identify relations between sentences and questions as well as relations between sentences
- Example:

  Q: What *[sorts of]* *[law-enforcement]* *[tasks]* are [*dogs*] being used for worldwide? What *[law-enforcement agencies]* are using dogs? What *[breeds]* of *[dogs]* are being used?



Semantic Role Label (SRL)

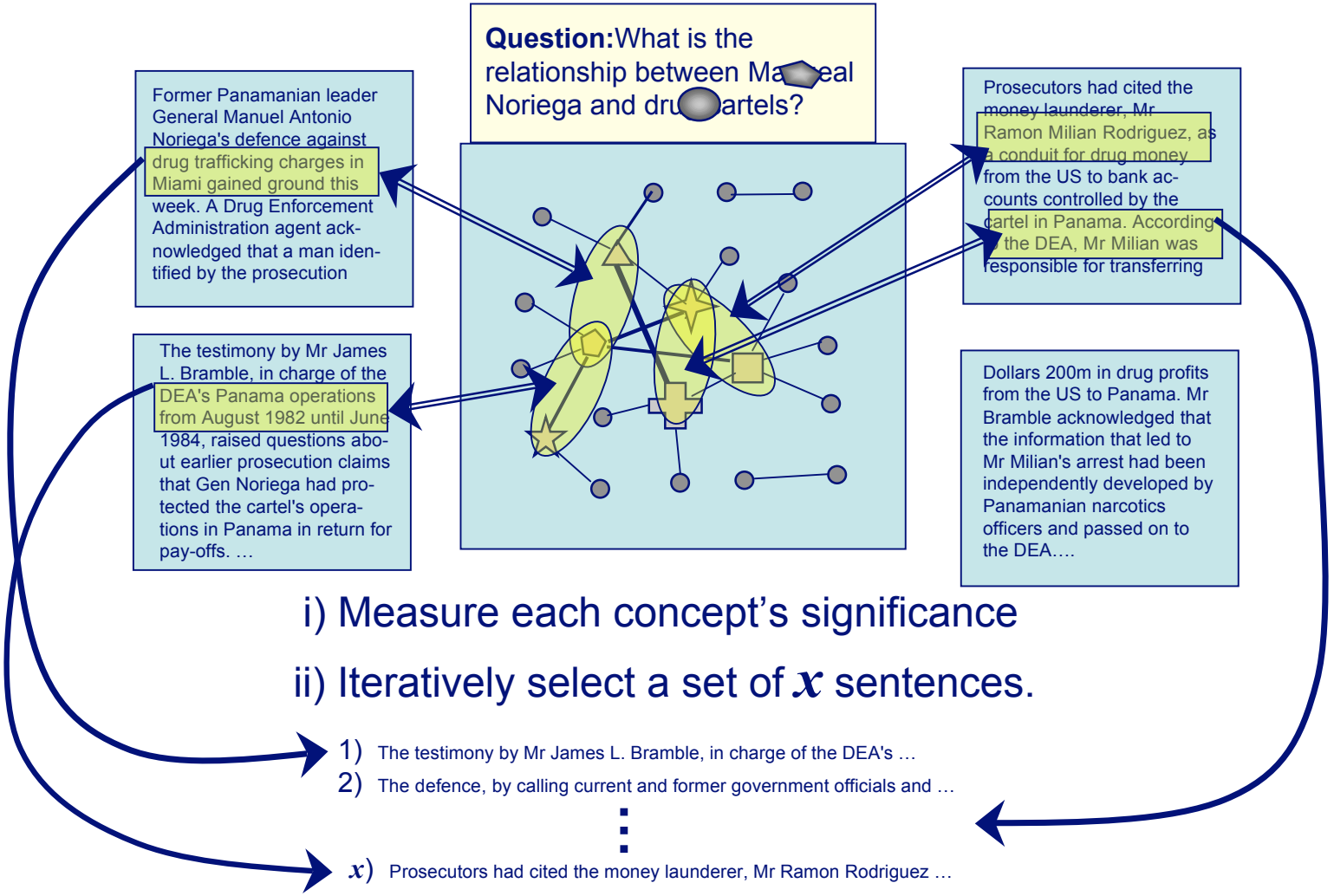
- Semantic Role
  - The relationship that a syntactic constituent has with a predicate
- Example
  - Late buying gave the Paris Bourse a parachute after its free fall early in the day

[A_0 Late buying][*V* gave][A_2 the Paris Bourse]
[A_1 a parachute] [*AM-TMP* after its free …the day]

SRL in SQuASH

- SRL in Sentence Extraction
  - Each clause (predicate and core arguments in SRL) gets a score
  - A sentence is selected by its single highest scoring clause
- SRL in Sentence Compression
  - Remove adjuncts (ARG-DIS, ARG-TMP)
  - Sentence syntactically correct without losing important semantic information
- Use ASSERT (Pradhan et al. 2004)
  - Precision 84%, F-score 79.4% on PropBank Corpus

Sentence Extraction



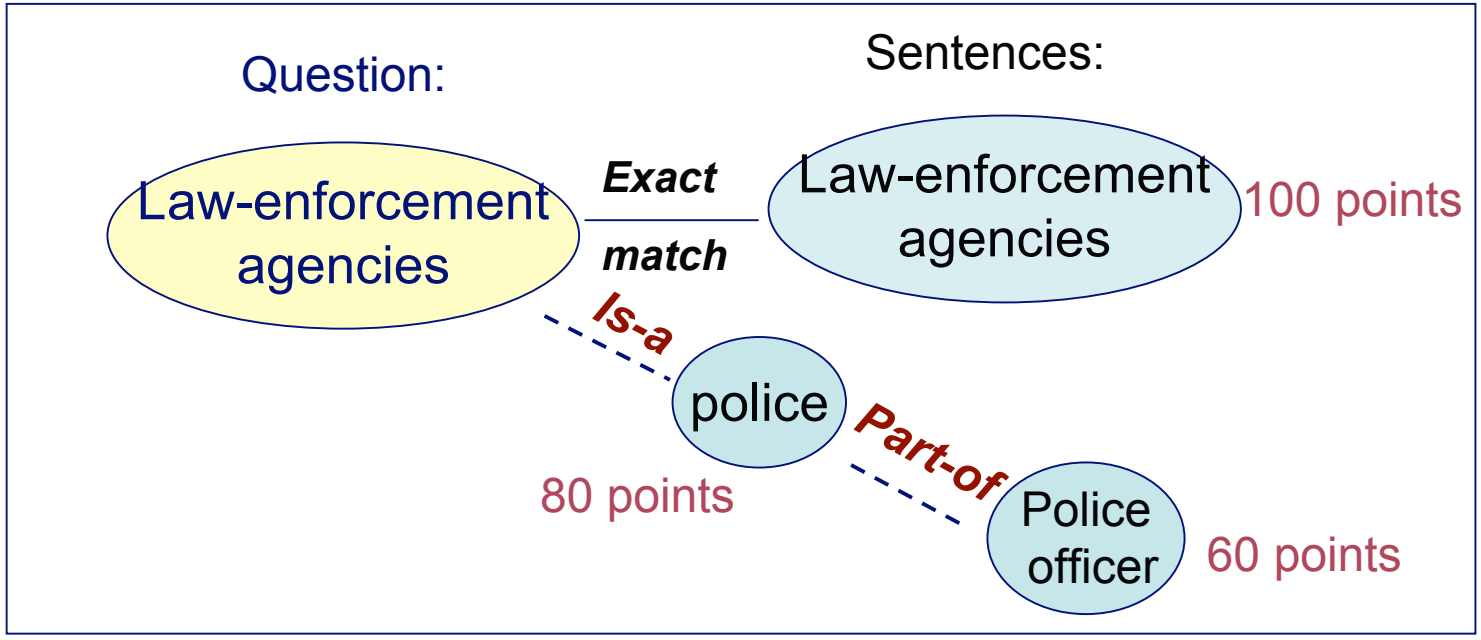
Extractor Features

- Concept in clause appears in question
- *Semantic relatedness of clause to question concept*
- Number of Named Entities in clause
- Number of documents in which the concepts from a clause appear
- Number of sentences in which the concepts from a clause appear
- *First Sentence bias*

Concept Relatedness

- The concept ‘score’ decreases as the distance of relatedness increases.
- Example:

  Q: What *[sorts of] [law-enforcement] [tasks]* are [*dogs*] being used for worldwide? What *[law enforcement agencies]* are using dogs? What *[breeds]* of *[dogs]* are being used?



Sentence Compression

- Motivation
  - Improves the ROUGE score on DUC05 data
  - Rouge 2 from 0.0649 to 0.0714
  - Rouge SU-4 from 0.1171 to 0.1284
- New handling of rules
  - Remove temporal and discourse conjunctives based on **Semantic Role Labels:** ARG-TMP and ARG-DIS
  - Remove sentences starting with pronouns excluding “it”

Sentence Ordering (1)

- **Assumption**
  - Semantically related sentences are ordered together [Barzilay, 2002]
- **Approach**
  - Semantic relatedness on the question level
    - Cluster sentences based on questions
  - Semantic relatedness on the sentence level
    - Use *WordNet Concept relations* to calculate the lexical cohesion between sentences
  - Pick the 1st sentence of the summary: Prefer the original 1st sentence

Sentence Ordering (2)

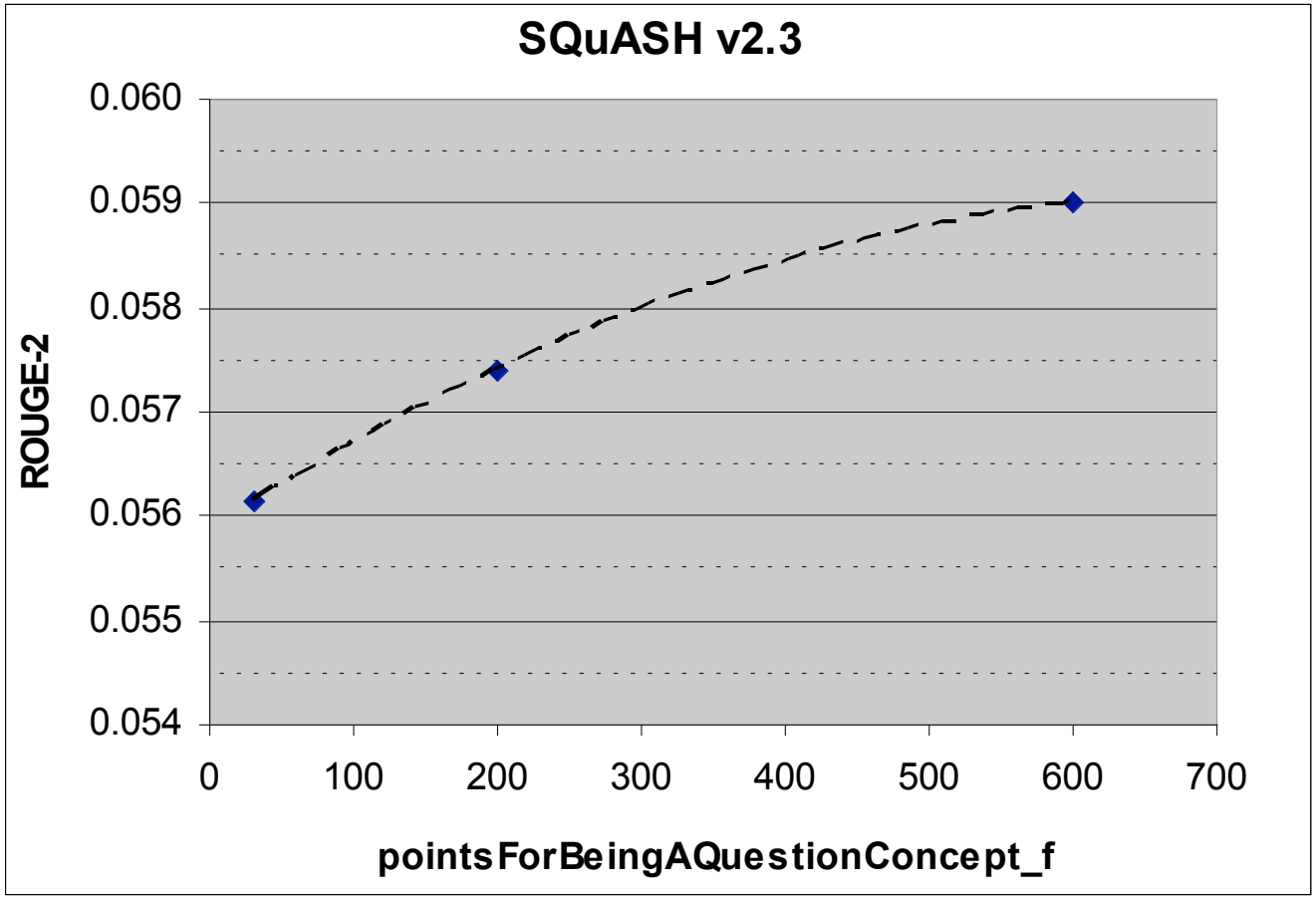
- **Evaluation**
  - compare summary with ordering and without ordering (a ranked sentence list from Extractor) on DUC 06 data
  - Gather coherence judgments from 5 subjects
  - Summary with ordering is better than summary without ordering

With Order / W/o Order	Good	Bad
Good	8	12
Bad	20	6

Model Optimization

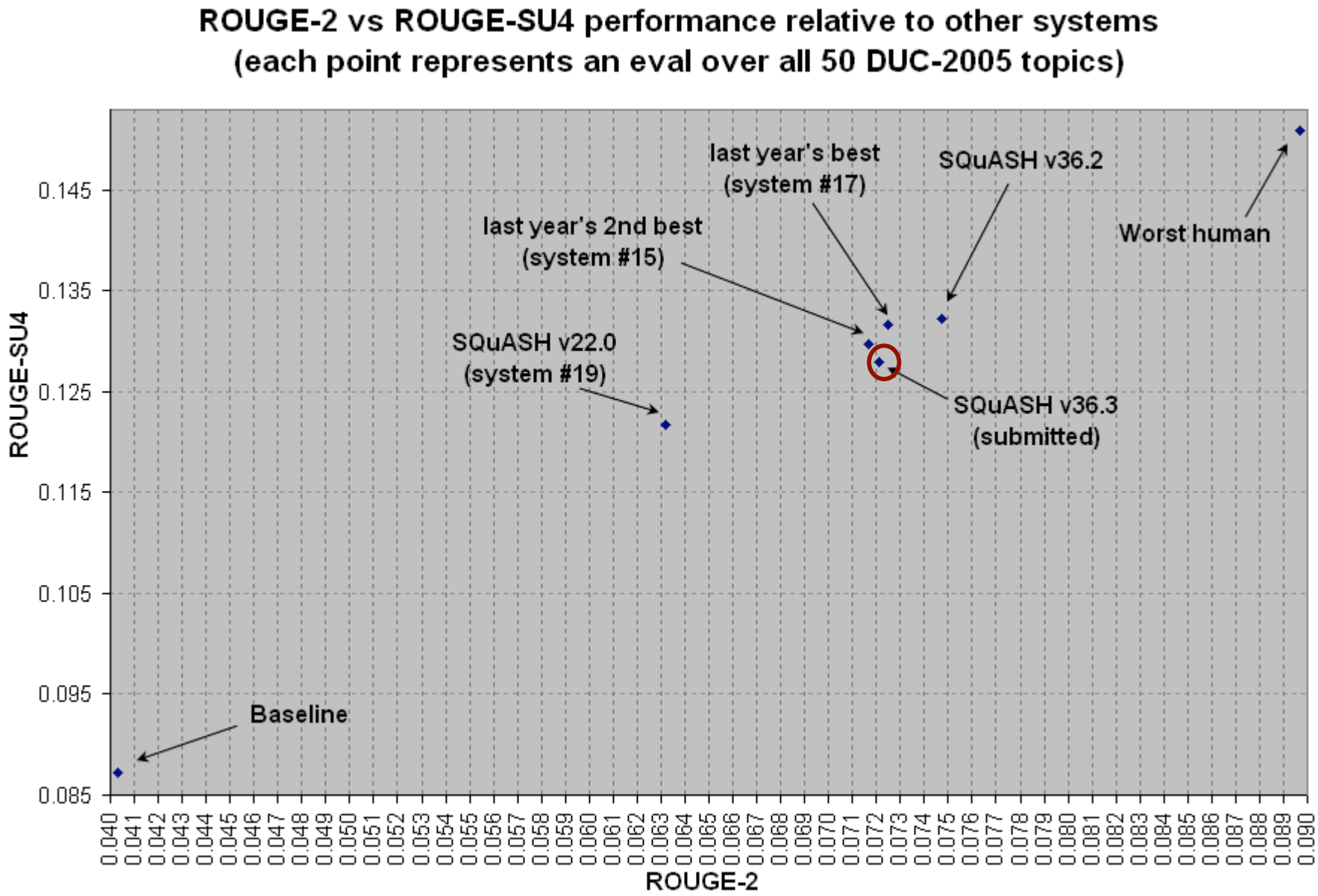
- Automatically tune and optimize the weights based on ROUGE-2 / SU-4 score on DUC-05 data
- Greedy hill-climbing technique
- The weight for each feature was optimized separately

Sample of Optimization Exercise

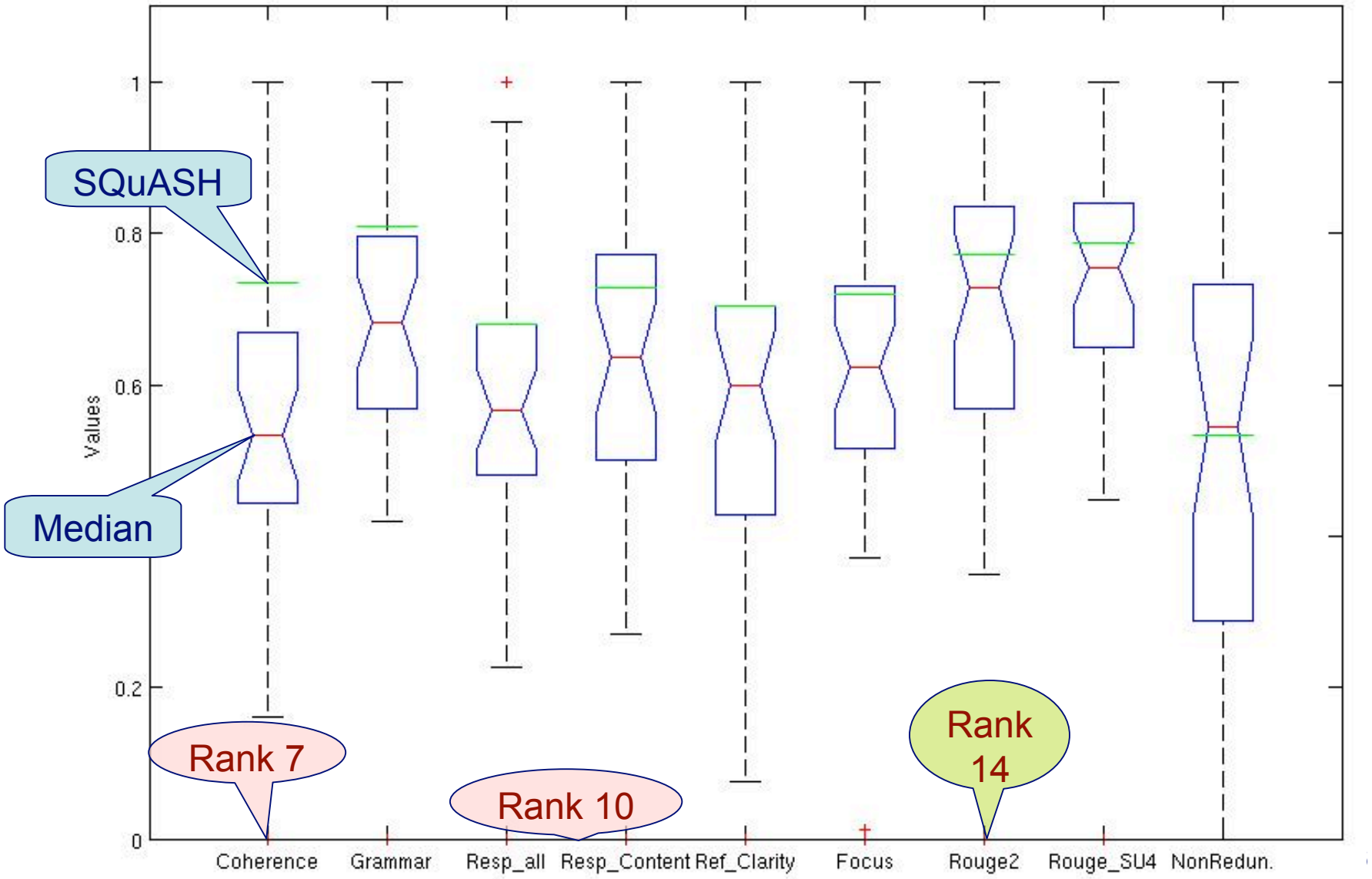


Greens

System Optimization



Performance Analysis



Performance Analysis

- Correlation between content responsiveness and structure & coherence

Content Responsiveness	Percent	Structure & Coherence	
		Good (5,4)	Bad (2,1)
5	2.95%	51%	16%
4	15.76%	31%	38%
3	30.41%	16.25%	57.45%
2	36.06%	9%	67%
1	6.47%	4%	80%

Future Work

- Annotator
  - Improve recall in Semantic Role Labeling
- Extractor
  - Discriminative model between the document text graphs and the human summaries
  - Link text graph vertices to an ontology.

    E.g. **PERSON**, **LOCATION**, and **ORGANIZATION** ontology.

Future Work

- Editor
  - Conduct the experiment study to test the hypothesis of relations between query and sentence ordering
  - Incorporate the query in sentence compression and develop more sophisticated compression model

Thank you !