

AutoSUM: Automating Feature Extraction and Multi-user Preference Simulation for Entity Summarization



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Introduction

■ Task Definition

Entity summarization is the problem of identifying a limited number of ordered RDF triples that summarize an entity in the best way—the result is typically presented in knowledge panels.

■ Application

The screenshot shows a Google search for "hagar wilde". The search results include a knowledge panel for Hagar Wilde, a writer. The panel displays her name, profession (Writer), a portrait photo, and a summary of her life and work. It also lists her birth and death dates, her place of birth and death, and her nominations. Below the summary, there is a section for movies, showing five film posters: "Bringing Up Baby", "I Was a Male War Bride", "Carefree", "Red, Hot and Blue", and "The Unseen".

Google search results for "hagar wilde". The search results include a knowledge panel for Hagar Wilde, a writer. The panel displays her name, profession (Writer), a portrait photo, and a summary of her life and work. It also lists her birth and death dates, her place of birth and death, and her nominations. Below the summary, there is a section for movies, showing five film posters: "Bringing Up Baby", "I Was a Male War Bride", "Carefree", "Red, Hot and Blue", and "The Unseen".

- *A description card based on entity summarization*



Introduction

■ Example

Query a subject named **Hagar Wilde** in DBpedia with SPARQL:

Virtuoso SPARQL Query Editor

Default Data Set Name (Graph IRI)

<http://dbpedia.org>

Query Text

```
Select distinct ?Predicate ?Object where
{
  <http://dbpedia.org/resource/Hagar\_Wilde>
  ?Predicate
  ?Object
}
```

→

Predicate	Object
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Thing
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://xmlns.com/foaf/0.1/Person
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://dbpedia.org/ontology/Person
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Agent
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#NaturalPerson
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.wikidata.org/entity/Q215627
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.wikidata.org/entity/Q24229398

- **RDF triples:** <Subject, Predicate, Object>
- Search Hager Wilde in DBpedia: <**Hagar Wilde**, Predicate, Object>
- Total **65** RDF triples



Introduction

■ Example

Select *Top-5* triples from total 65 triples mentioned above:

```
<http://dbpedia.org/ontology/basedOn> <http://dbpedia.org/resource/Hagar_Wilde> .  
<http://dbpedia.org/ontology/birthDate> "1905-07-07"^^<http://www.w3.org/2001/XMLSchema#date> .  
<http://dbpedia.org/ontology/deathDate> "1971-09-25"^^<http://www.w3.org/2001/XMLSchema#date> .  
<http://xmlns.com/foaf/0.1/name> "Hagar Wilde"@en .  
<http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://dbpedia.org/class/yago/WomenTelevisionWriters> .
```

Top-5 predicate-object pairs of subject *Hagar Wilde*

Predicate	Object
Name	Hagar Wilde
Type	WomenTelevisionWriters
Birthdate	1905-07-07
Deathdate	1971-09-25



A screenshot of the Wikipedia page for Hagar Wilde, enclosed in a red border. The page includes a portrait of Hagar Wilde, her name in a large font, and her occupation as a writer. It provides biographical details such as her birth date (7 July 1905) and death date (25 September 1971). It also lists her nominations, including the Writers Guild of America Award for Best Written Comedy. At the bottom, there is a section for movies, featuring four film posters: 'Bringing Up Baby' (1938), 'I Was a Male War Bride' (1949), 'Carefree' (1938), and 'Red, Hot and Blue' (1949). A red arrow points from the table on the left to this screenshot.

Hagar Wilde Writer

Hagar Wilde was a writer for Hollywood films and television shows in the late thirties till the late fifties. [Wikipedia](#)

Born: 7 July 1905, [United States of America](#)
Died: 25 September 1971, [Los Angeles, California, United States](#)

Nominations: [Writers Guild of America Award for Best Written Comedy](#)

Movies View 3+ more

 **Bringing Up Baby**
1938

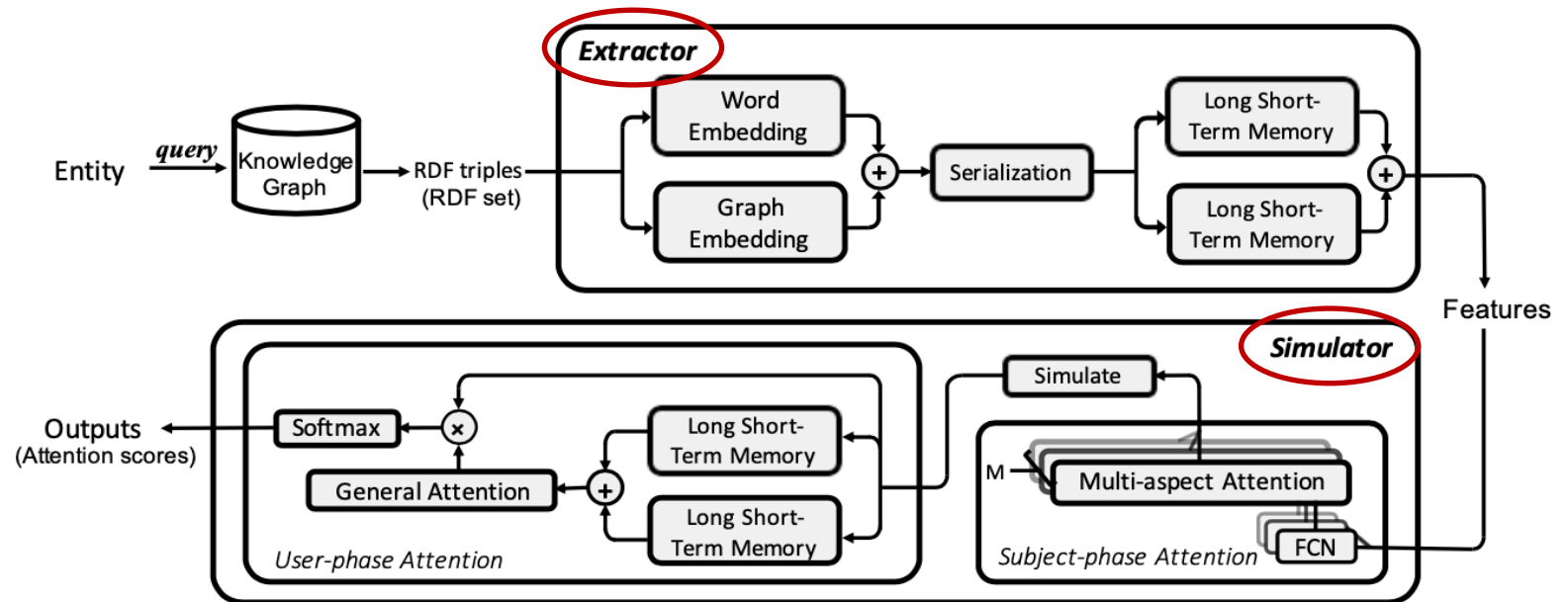
 **I Was a Male War Bride**
1949

 **Carefree**
1938

 **Red, Hot and Blue**
1949

The Architecture of AutoSUM

Overview



- **Extractor:** Feature Extraction
- **Simulator:** Multi-user Preference Simulation



Extractor: Feature Extraction

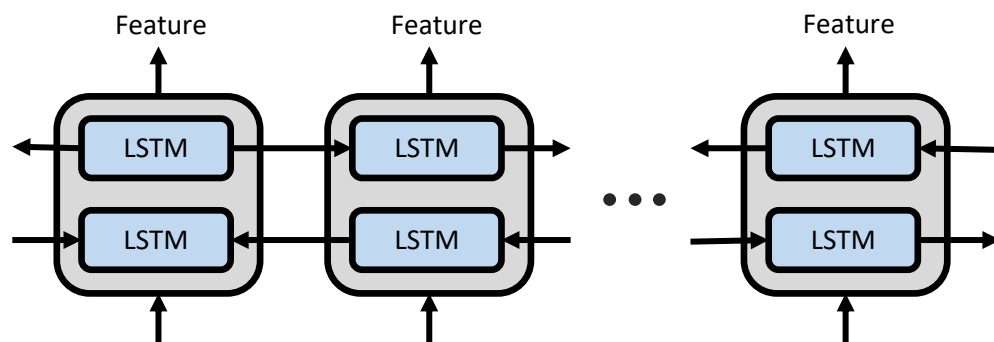
■ Example

◆ Input representation



- *Word embedding + Graph embedding = Input representation*

◆ Automatic feature extraction



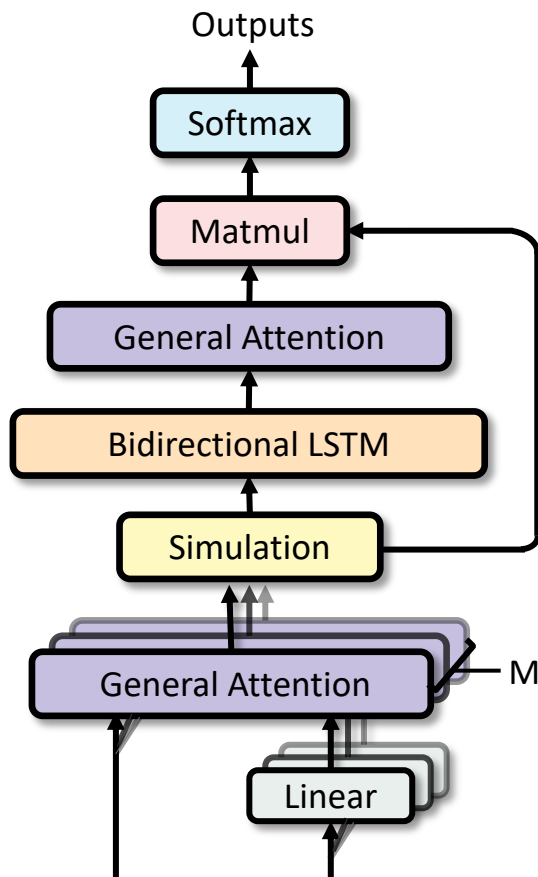
- *Bidirectional Long-short Term Memory Network -> extraction*



Simulator: Multi-user Preference

■ Simulator

◆ Entity & User Phase Attention



User Phase Attention

- *Attention scores = User preference*
- *BiLSTM + Attention -> allocate different scores to different users*

Entity Phase Attention

- *General Attention Score Function -> allocate different score to different entities*



Experiment

■ Settings

◆ ESBM Datasets

- ◆ DBpedia
- ◆ LMDb

◆ Metrics

- ◆ F-measure
- ◆ MAP

◆ Baselines

- ◆ RELIN [3]
- ◆ DIVERSUM [4]
- ◆ CD [5]
- ◆ FACES [6]
- ◆ FACES-E [7]
- ◆ LINKSUM [8]
- ◆ ESA [2]



Experiment

Results

F-measure

Model	DBpedia		LinkedMDB		ALL		↑ %		
	k = 5	k = 10	k = 5	k = 10	k = 5	k = 10	min	max	avg
RELIN	0.242	0.455	0.203	0.258	0.231	0.399	25	118	72
DIVERSUM	0.249	0.507	0.207	0.358	0.237	0.464	12	114	54
CD	0.287	0.517	0.211	0.328	0.252	0.455	10	110	52
FACES	0.270	0.428	0.169	0.263	0.241	0.381	23	162	73
FACES-E	0.280	0.488	0.313	0.393	0.289	0.461	17	48	38
LINKSUM	0.274	0.479	0.140	0.279	0.236	0.421	18	216	80
ESA	0.310	0.525	0.320	0.403	0.312	0.491	8	38	26
AutoSUM	0.387⁺	0.569⁺	0.443⁺	0.556⁺	0.403⁺	0.565⁺	-	-	-
AutoSUM ¹	0.303 ⁻	0.425 ⁻	0.316	0.442 ⁻	0.290 ⁻	0.462 ⁻	22	40	31
AutoSUM ²	0.316 ⁺	0.538	0.375 ⁺	0.463 ⁻	0.333 ⁻	0.517 ⁺	6	22	16
AutoSUM ³	0.221 ⁻	0.390 ⁻	0.330 ⁺	0.406 ⁻	0.252 ⁻	0.394 ⁻	34	75	49
AutoSUM ⁴	0.254 ⁻	0.417 ⁻	0.309	0.394 ⁻	0.270 ⁻	0.411 ⁻	36	52	43
AutoSUM ⁵	0.325 ⁺	0.532 ⁺	0.343 ⁻	0.413 ⁺	0.323	0.502 ⁺	7	35	21

- *Traditional Methods*
- *Neural Network*
- *AutoSUMs*

MAP

Model	DBpedia		LinkedMDB		ALL		↑ %		
	k = 5	k = 10	k = 5	k = 10	k = 5	k = 10	min	max	avg
RELIN	0.342	0.519	0.241	0.335	0.313	0.466	25	115	55
DIVERSUM	0.310	0.499	0.266	0.390	0.298	0.468	30	94	53
CD	-	-	-	-	-	-	-	-	-
FACES	0.255	0.382	0.155	0.273	0.227	0.351	69	234	114
FACES-E	0.388	0.564	0.341	0.435	0.375	0.527	15	64	36
LinkSUM	0.242	0.271	0.141	0.279	0.213	0.345	68	267	132
ESA	0.392	0.582	0.367	0.465	0.386	0.549	11	41	23
AutoSUM	0.459⁺	0.647⁺	0.517⁺	0.600⁺	0.476⁺	0.633⁺	-	-	-
AutoSUM ¹	0.419 ⁻	0.508 ⁻	0.420 ⁺	0.522 ⁺	0.389 ⁻	0.563	10	27	18
AutoSUM ²	0.404	0.598 ⁻	0.431 ⁺	0.525 ⁺	0.412 ⁻	0.578 ⁺	8	20	14
AutoSUM ³	0.291 ⁻	0.456 ⁻	0.383 ⁺	0.488 ⁺	0.317 ⁻	0.465 ⁻	23	58	41
AutoSUM ⁴	0.333 ⁻	0.486 ⁻	0.376 ⁻	0.467	0.346 ⁻	0.480 ⁻	28	38	34
AutoSUM ⁵	0.405 ⁺	0.582	0.368	0.473	0.412 ⁺	0.550	11	40	21

- *Traditional Methods*
- *Neural Network*
- *AutoSUMs*



Conclusions

■ Conclusions

- ◆ a novel integration model
- ◆ the performance is significantly better than other methods in both F-measure and MAP.
- ◆ sufficient ablation studies are provided to demonstrate the effectiveness of each module in AutoSUM

■ Future Works

- ◆ expand the ESBM dataset
- ◆ introduce the notion of AutoSUM into other applications such as recommender systems



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Thanks!
Q&A.

