

REWARDING COREFERENCE RESOLVERS FOR BEING CONSISTENT WITH WORLD KNOWLEDGE

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MOTIVATION

- Annotations are costly and difficult to obtain
- Many mentions co-occur infrequently which makes linking them harder

Lynyrd Skynyrd was formed in Florida. Other bands from the Sunshine State include Fireflight and Marilyn Manson.



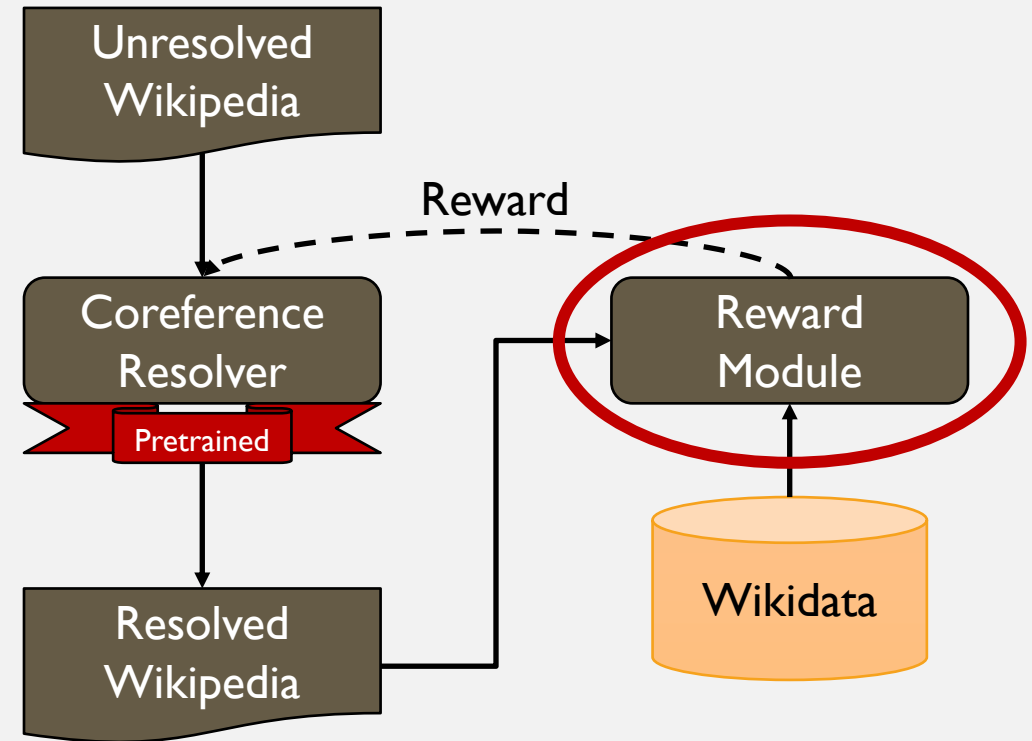
The diagram illustrates the challenge of linking co-occurring mentions. It shows a sentence with several entities highlighted in colored ovals: 'Lynyrd Skynyrd' (green), 'Florida' (blue), 'Sunshine State' (blue), 'Fireflight' (red), and 'Marilyn Manson' (yellow). A curved arrow points from the 'Florida' oval to the 'Sunshine State' oval, indicating that these two mentions refer to the same entity (the state of Florida) but are not directly linked by a simple co-occurrence in the sentence structure.

MOTIVATION

- Wikidata is used as the knowledge source
- Bender Rule: We only tackle English coreference resolution
- Can be easily expanded to other languages

IDEA

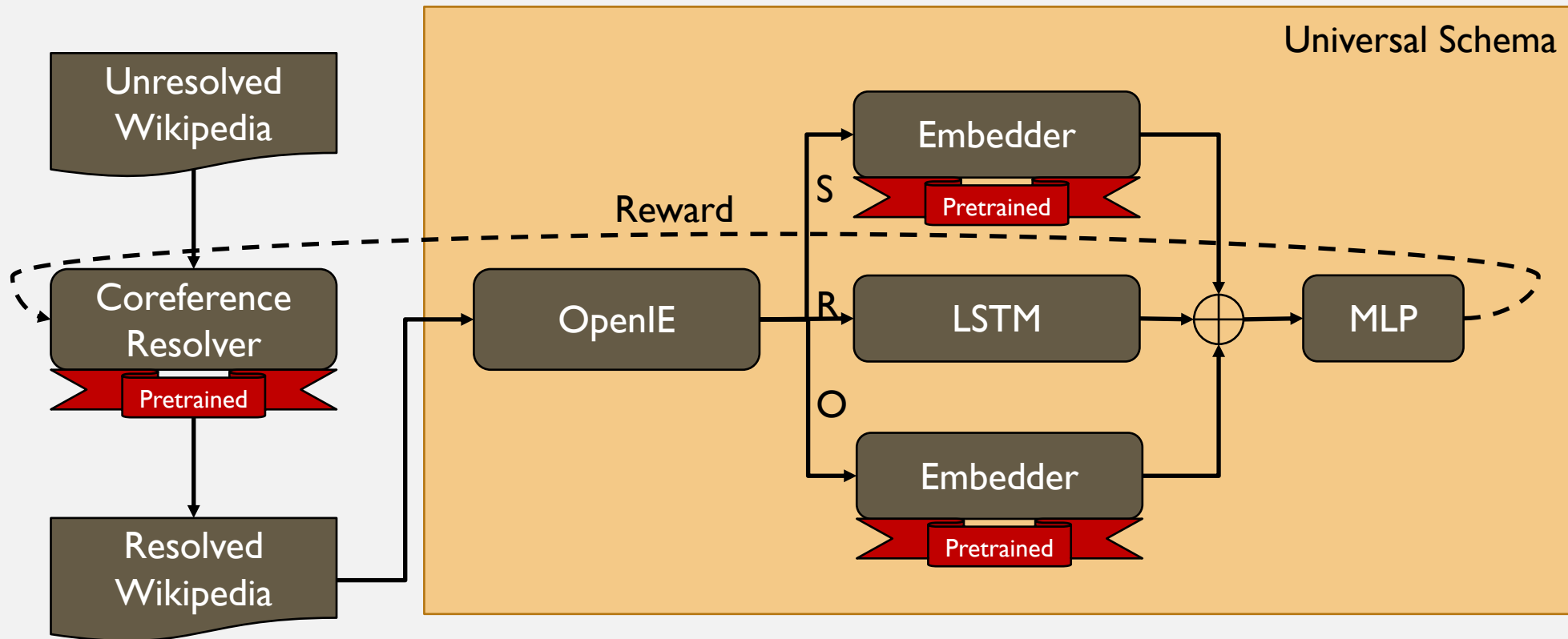
- Pre-train a coreference resolver (Lee et al, 2018) on a standard coreference dataset (OntoNotes)
- Resolve coreference on 10,000 Wikipedia documents
- Feed resolved documents into a reward model which checks for consistency against Wikidata



REWARD MODULE

- What if some knowledge is not available in Wikidata?
- How do we generalize the reward signal beyond the coverage of Wikidata?
- Universal Schema (Riedel et al, 2013)
- Generalizes to unseen relations

REWARD MODULE



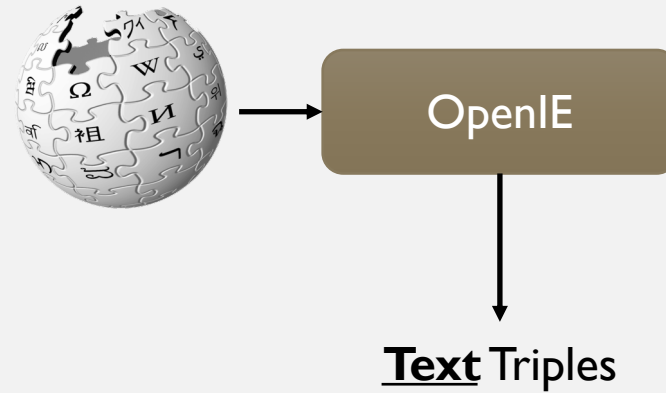
REWARD MODULE: TRAINING DATA

- **KG**: Triples from Wikidata



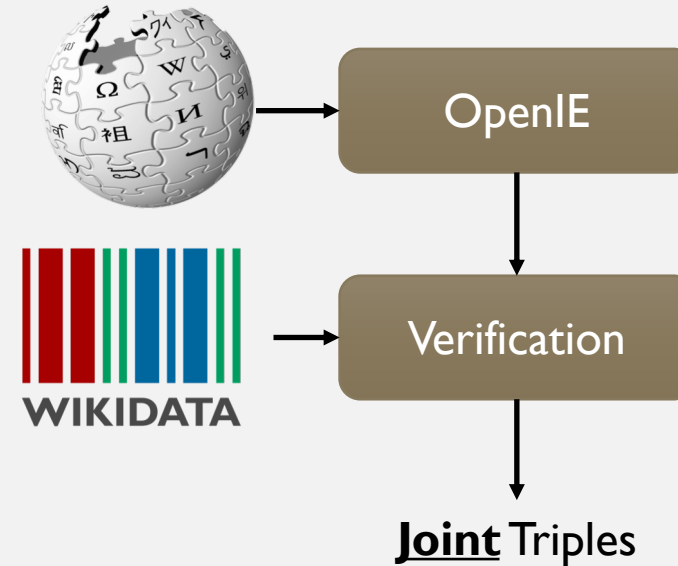
REWARD MODULE: TRAINING DATA

- **KG**: Triples from Wikidata
- **Text**: Triples generated from Wikipedia



REWARD MODULE: TRAINING DATA

- **KG**: Triples from Wikidata
- **Text**: Triples generated from Wikipedia
- **Joint**: Triples generated from Wikipedia and verified using Wikidata

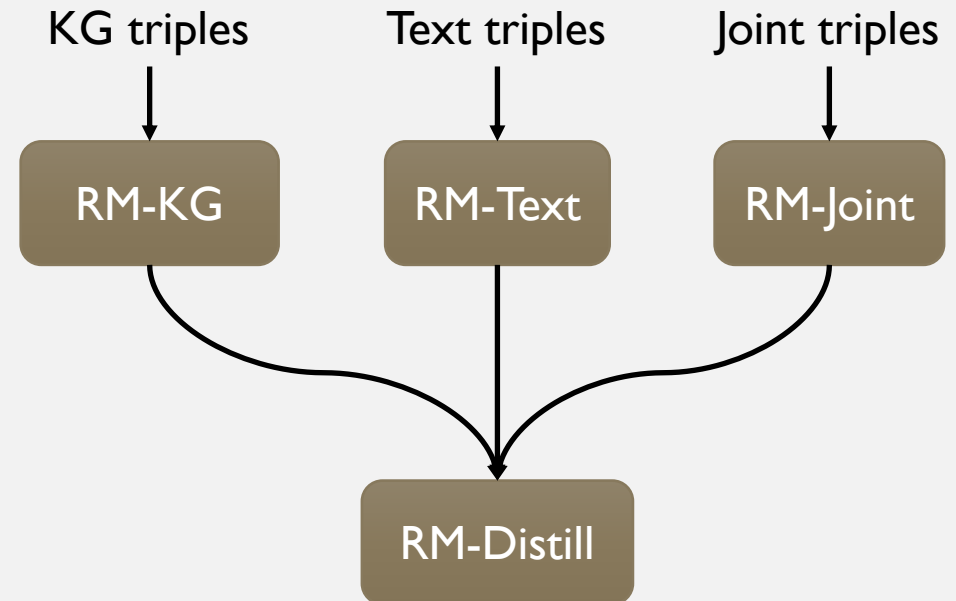


REWARD MODULE: TRAINING DATA

	KG triples	Text triples	Joint triples
Document	NA	Bach was a German composer. He is known for instrumental compositions such as the Art of Fugue	Bach was a German composer. He is known for instrumental compositions such as the Art of Fugue
OpenIE	NA	(Bach, born in, Germany) (Bach, occupation, Composer) (He, composition, Art of Fugue)	(Bach, born in, Germany) (Bach, occupation, Composer) (He, composition, Art of Fugue)
Verification	NA	NA	✗ (Bach, born in, Germany) ✓ (Bach, occupation, Composer) ✗ (He, composition, Art of Fugue)
Result	(Bach, born in, Eisenach) (Bach, born on, 21 March 1685) (Bach, occupation, Composer) ...	(Bach, born in, Germany) (Bach, occupation, Composer) (He, composition, Art of Fugue)	(Bach, occupation, Composer)

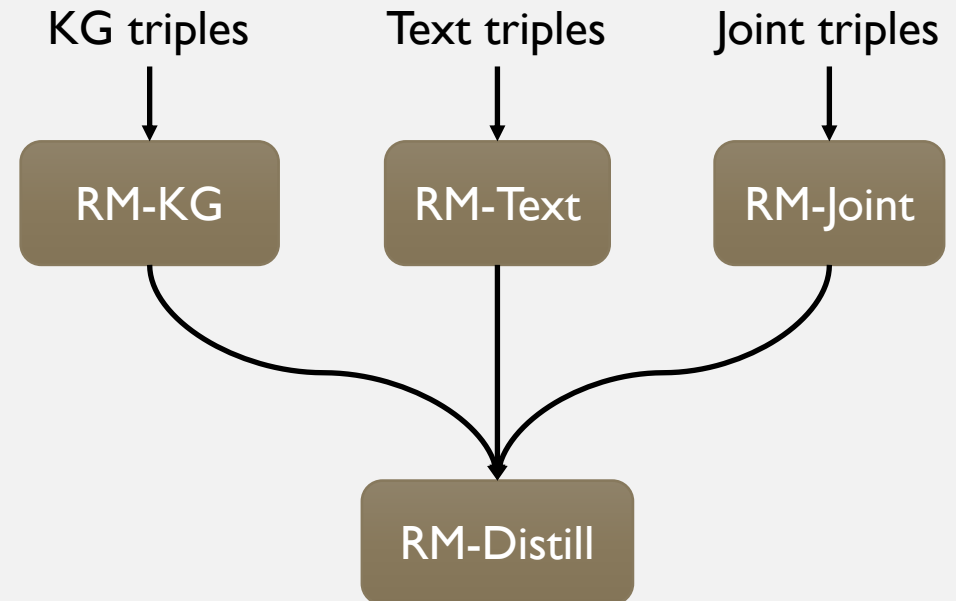
REWARD MODULE

- We train 3 reward modules using the 3 datasets
- We distill these 3 models to create RM-Distill

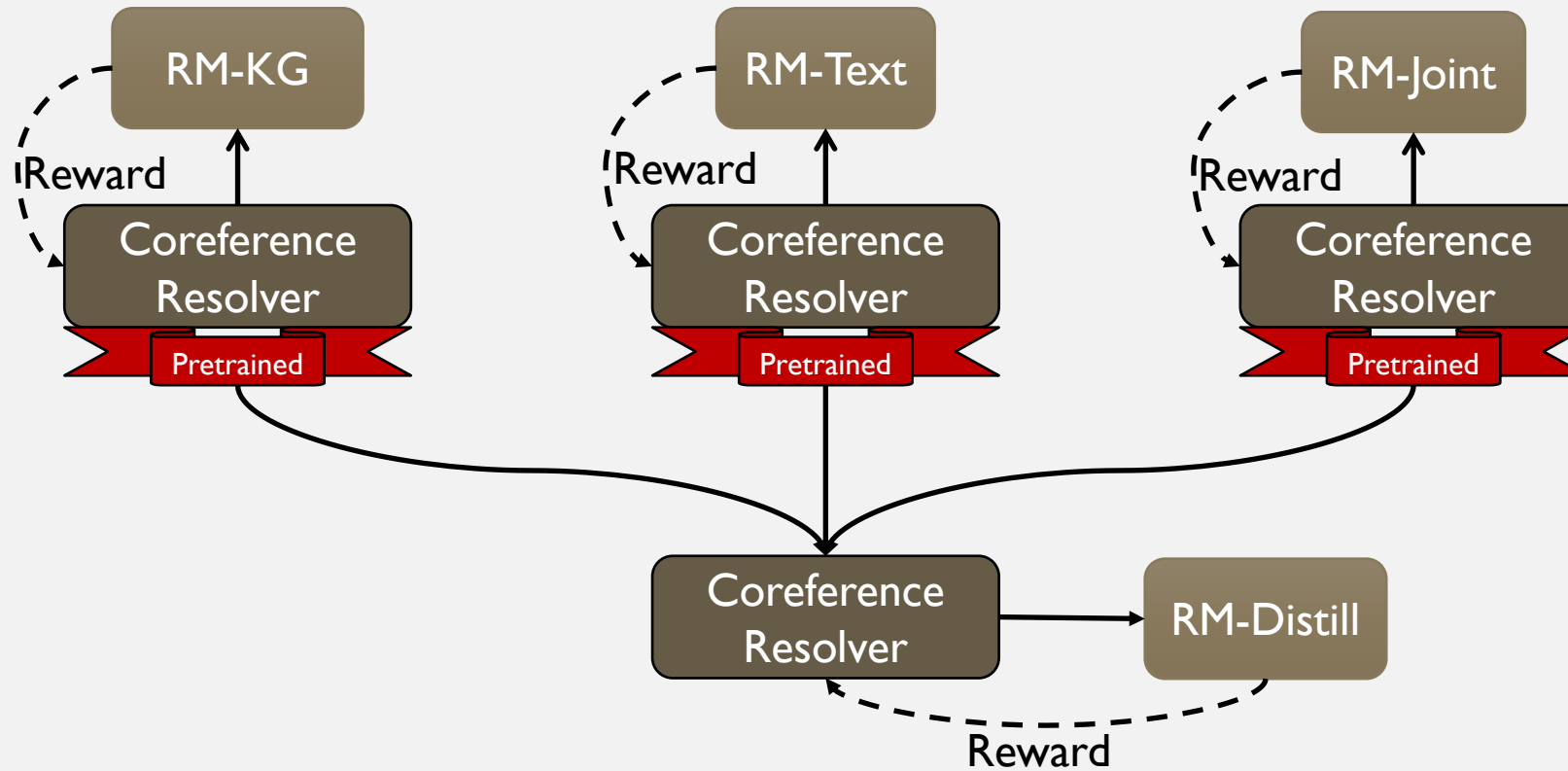


REWARD MODULE: RESULTS

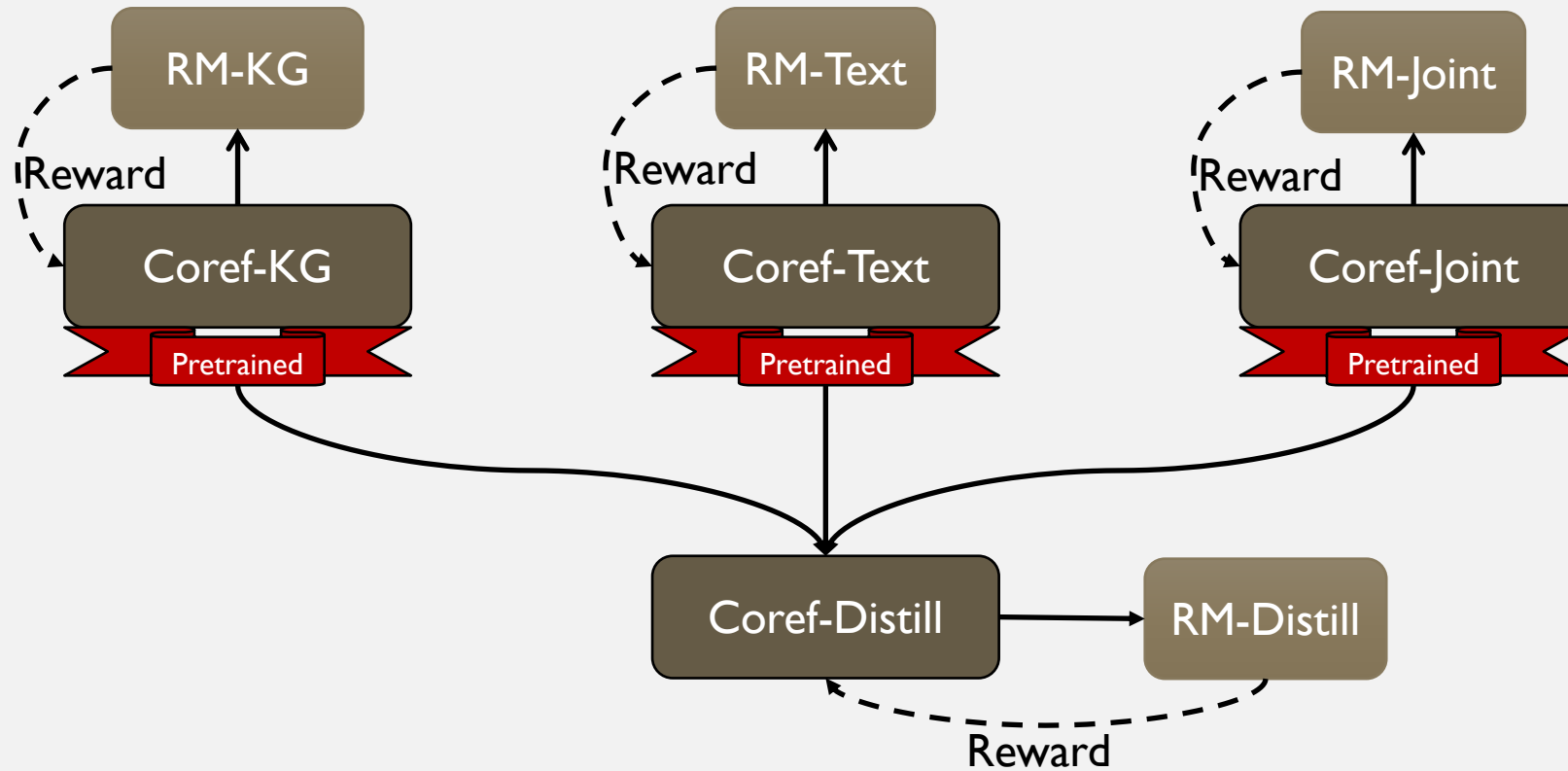
System	Data Size	Acc.	F ₁
RM-KG	12M	0.64	0.78
RM-Text	2M	0.71	0.83
RM-Joint	60K	0.58	0.73
RM-Distill	-	0.78	0.88



COREFERENCE: FINE-TUNING



COREFERENCE: FINE-TUNING



COREFERENCE: RESULTS

- All the systems were evaluated on OntoNotes and WikiCoref
- Coref-Distill performs the best on both evaluation datasets

System	OntoNotes	WikiCoref
<i>Lee et al.</i>	72.60	57.49
Coref-KG	72.96	57.84
Coref-Text	72.99	57.54
Coref-Joint	72.77	57.51
Coref-Distill	73.10	58.14

MENTION DETECTION

Baseline system

According to the library's publications, it is the largest academic library in the southern hemisphere. The university has a number of residential college and halls of residence, based on the college system of Cambridge and Oxford universities.

Fine-tuned system

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EVENTIVE LINKING

Baseline system

On March 19, Obama continued his outreach to the Muslim world, releasing a New Year's video message to the people and government of Iran. This attempt was rebuffed by the Iranian leadership.

Fine-tuned system

On March 19, Obama continued his outreach to the Muslim world, releasing a New Year's video message to the people and government of Iran. This attempt was rebuffed by the Iranian leadership.

CONCLUSION

- Being consistent with world knowledge improves coreference resolution
- The increase in precision is offset by the decrease in recall which results in only marginal overall improvement
- Hypothesis: this framework has potential to give bigger gain in other languages