Exploiting Category-Specific Information for Multi-Document Summarization

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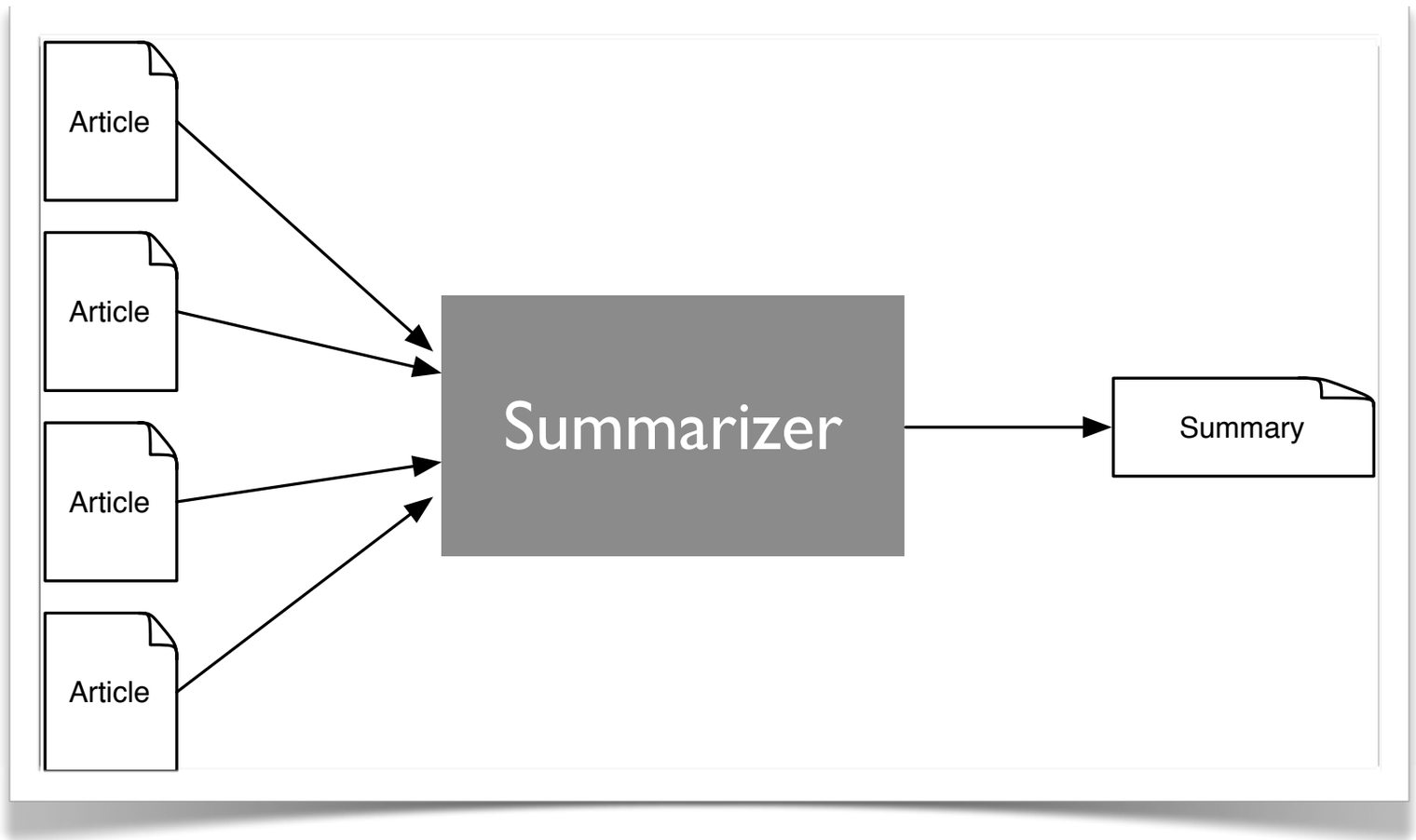
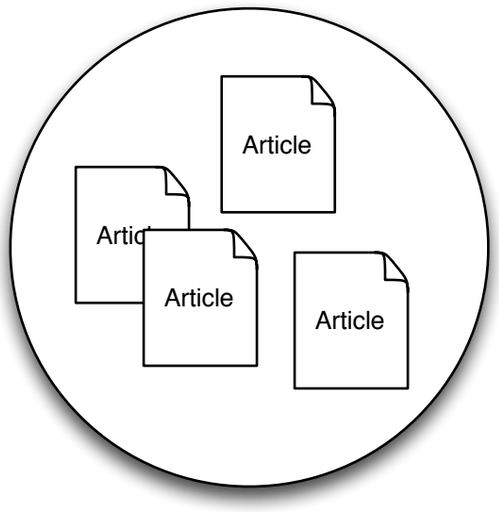
Min-Yen Kan Chew-Lim Tan

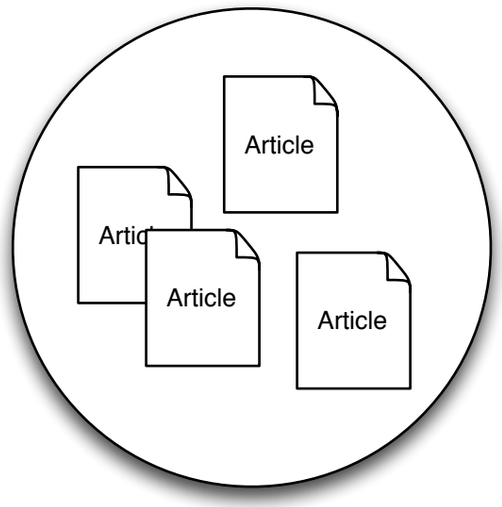
Multi-Document Summarization



A Realistic Scenario



2012 US Presidential Election



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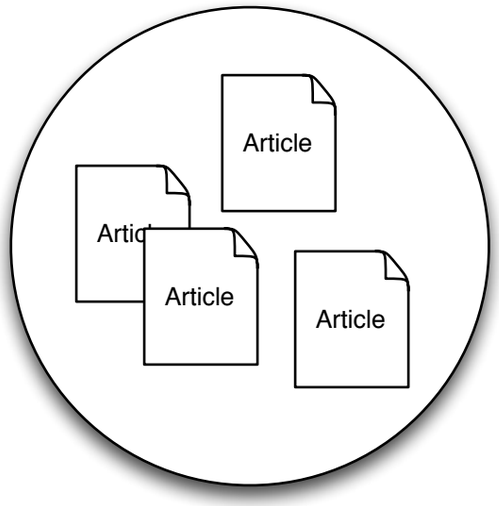
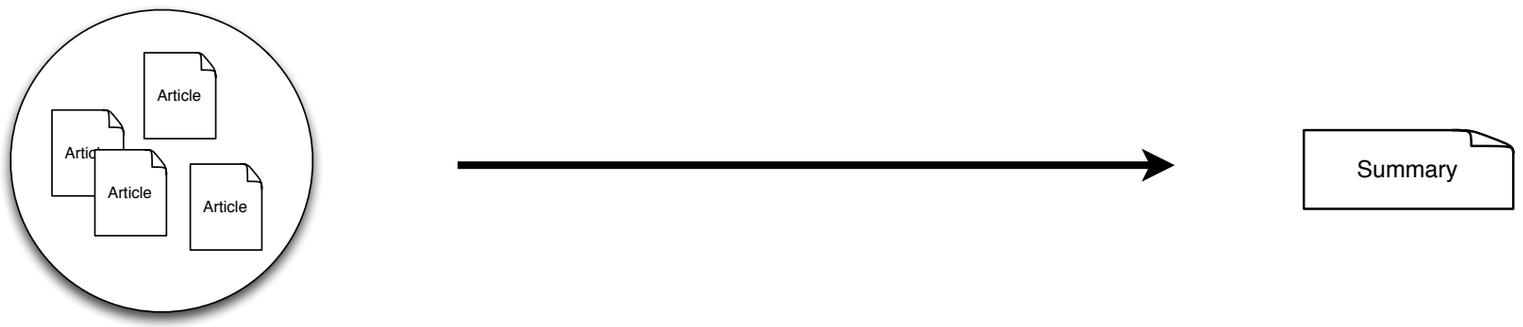


Hurricane Sandy

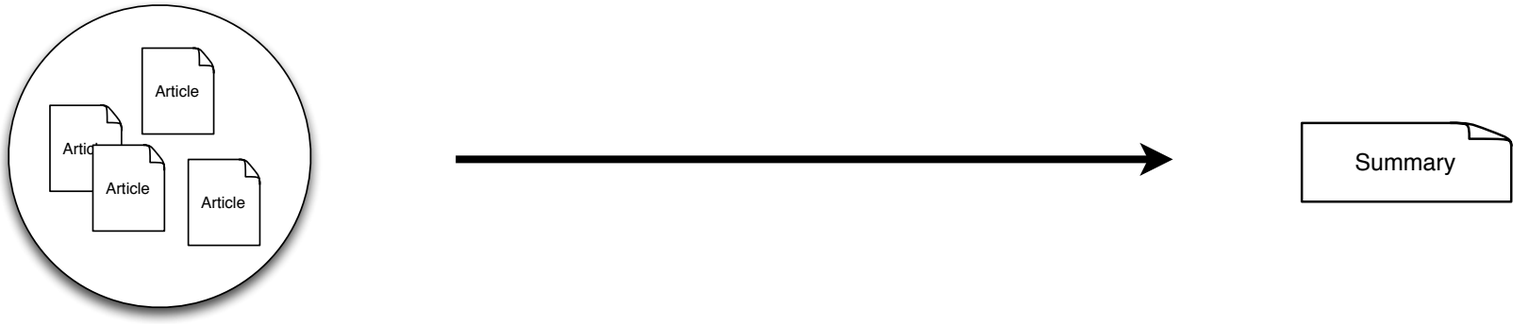
Typical Summarizers



2012 US Presidential Election

Typical Summarizers

2012 US Presidential Election

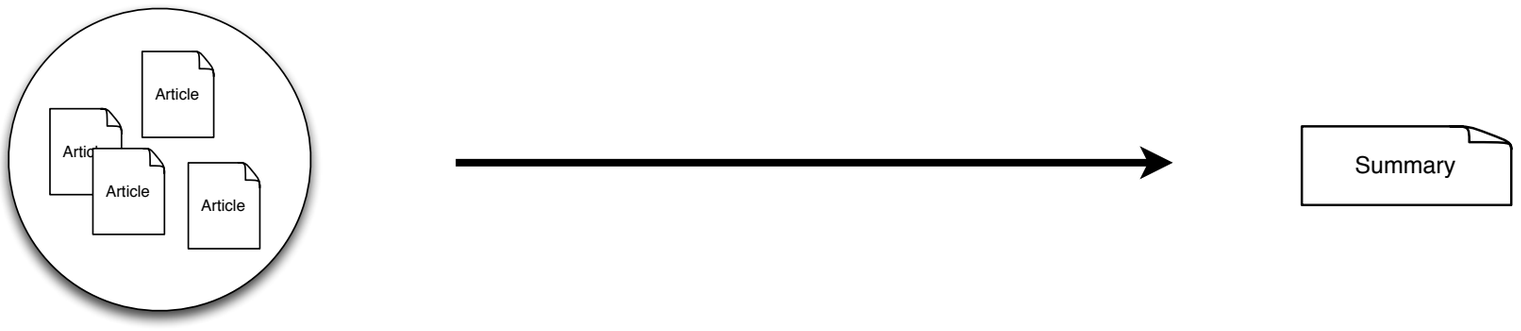


Hurricane Sandy

Typical Summarizers

2012 US Presidential Election

Hurricane Sandy



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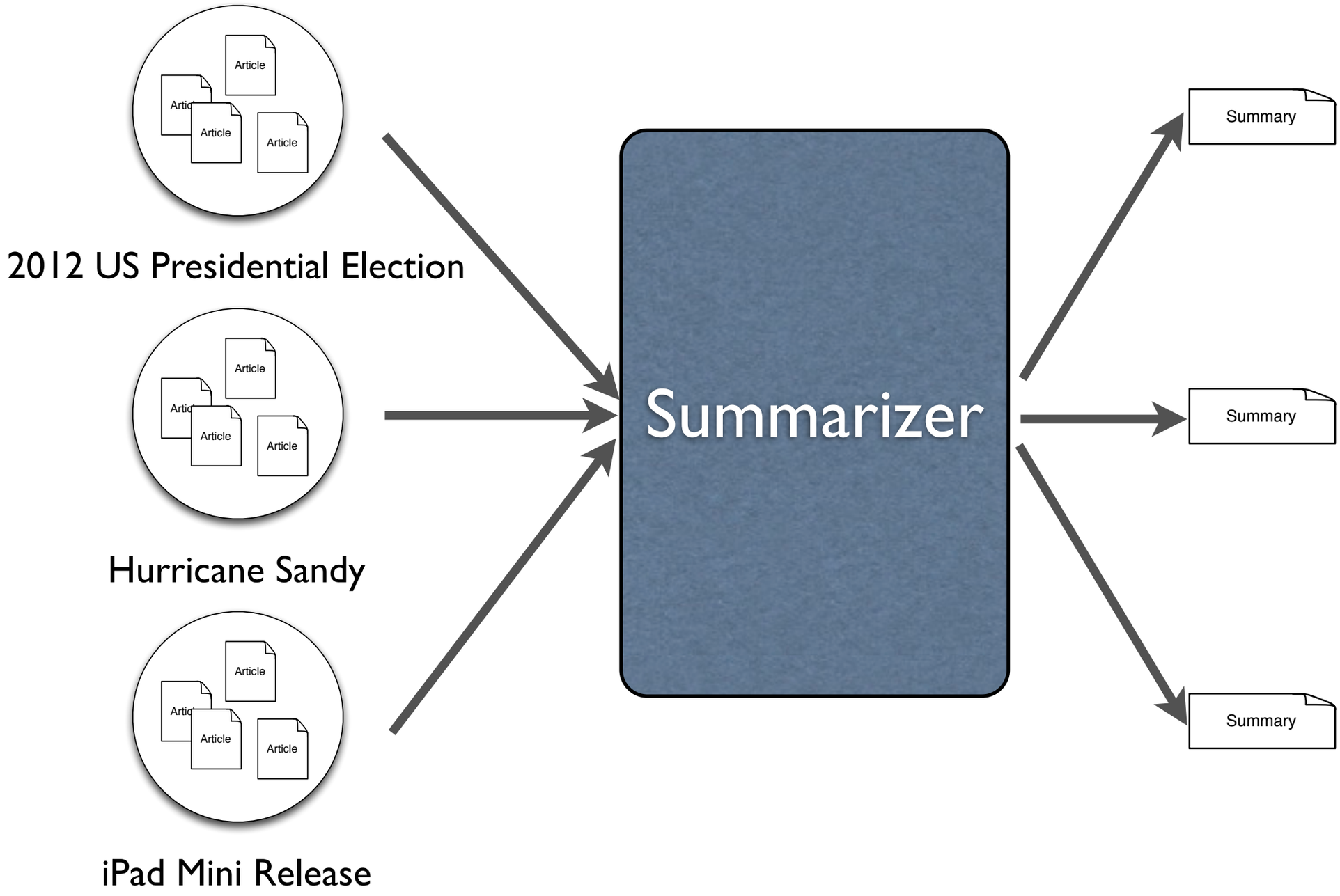
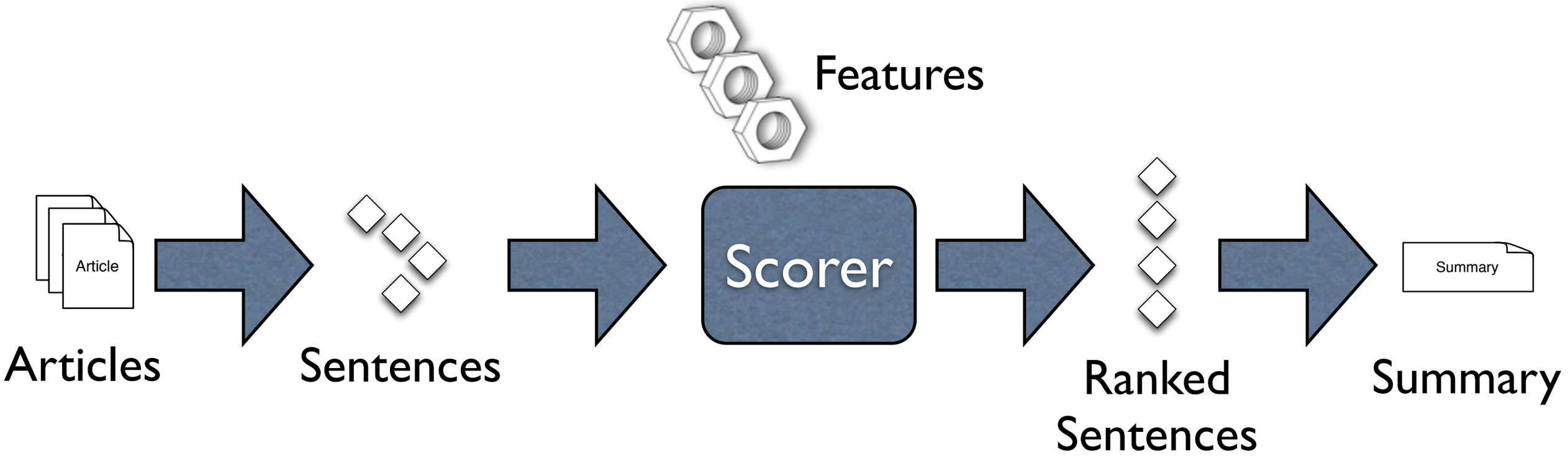
Key Insight


Article
Article
Article
2012 US Presidential Election
Article
Article
Article
Hurricane Sandy
Article
Article
Article
iPad Mini Release
Summarizer
Summary
Summary
Summary

Outline

- Baseline Summarization Pipeline
- Category-Specific Features
- Experiments

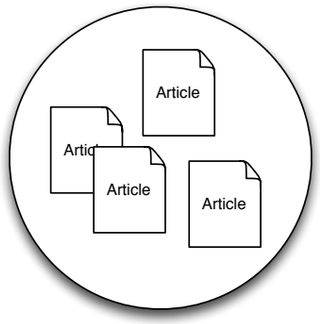
Pipeline


Features
Article
Scorer
Summary
Articles
Sentences
Ranked Sentences
Summary

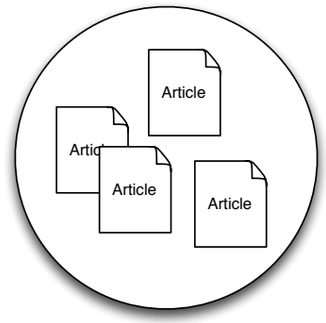
Generic Features

- Sentence position
- Sentence length
- Interpolated N-gram Document Frequency

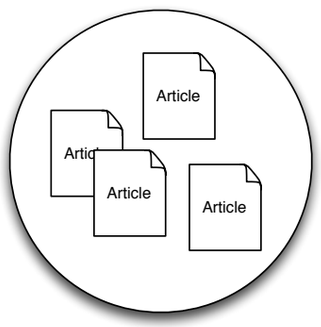
Category-Specific Features



2012 US Presidential Election



Hurricane Sandy



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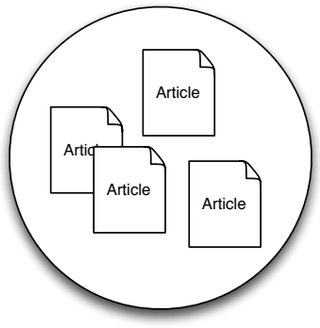
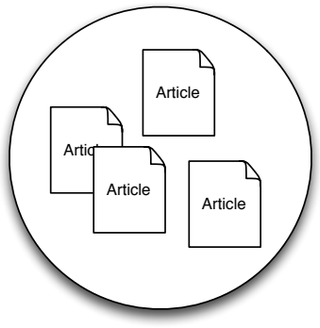
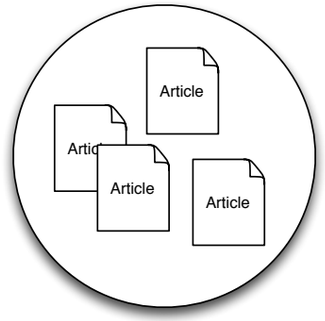
Category-Specific Features



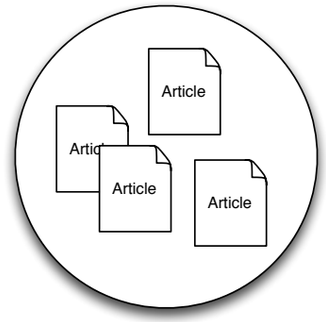
2012 US Presidential Election



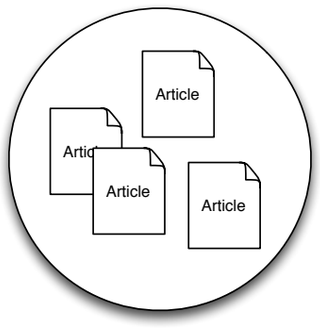
2011 UK Election



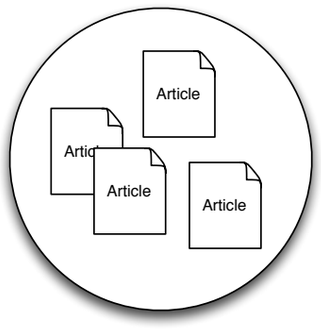
2012 Mynamar Earthquake



Hurricane Sandy



2012 Indian Assembly Elections



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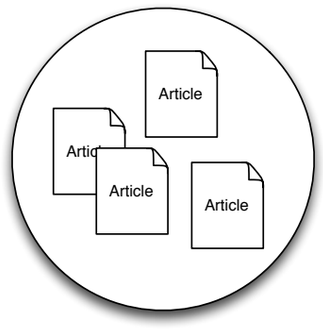
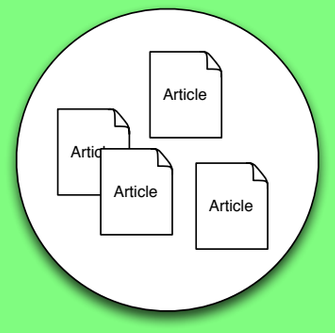
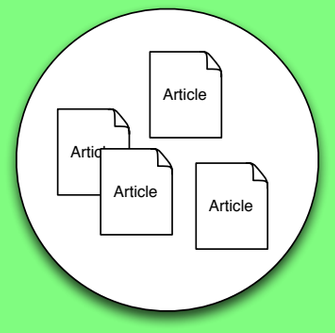


Nokia Lumia 920

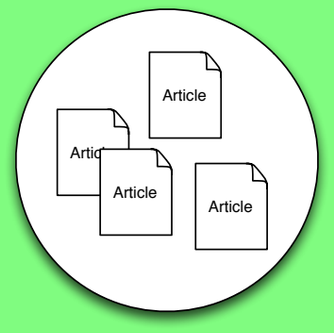
Category-Specific Features



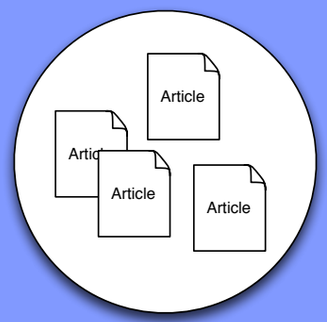


2012 US Presidential Election

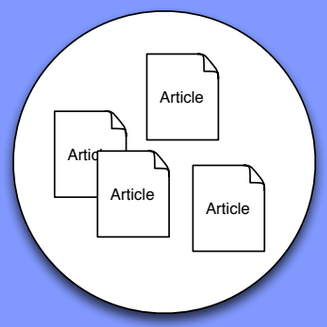
2011 UK Election



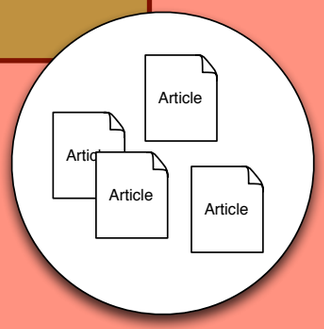
2012 Indian Assembly Elections



Hurricane Sandy



2012 Mynamar Earthquake



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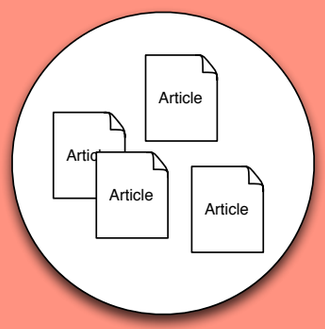
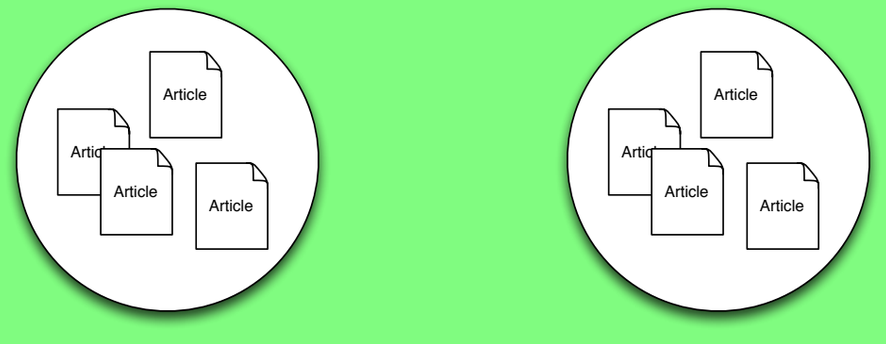


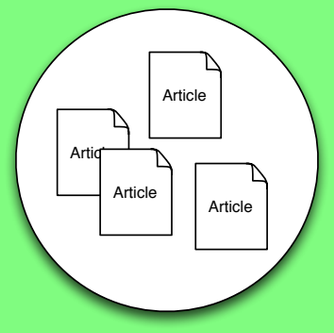
Nokia Lumia 920

Category-Specific Features

Disasters

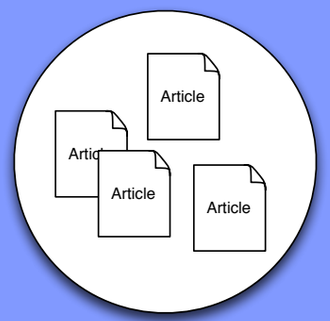


2012 US Presidential Election 2011 UK Election

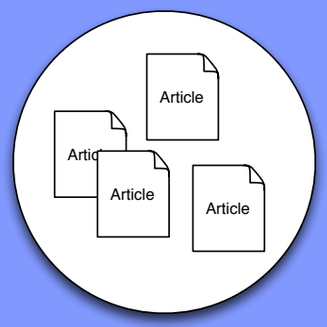


2012 Indian Assembly Elections

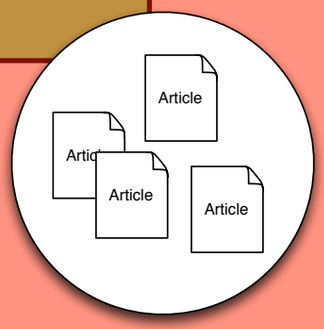
Political News



Hurricane Sandy



2012 Mynamar Earthquake



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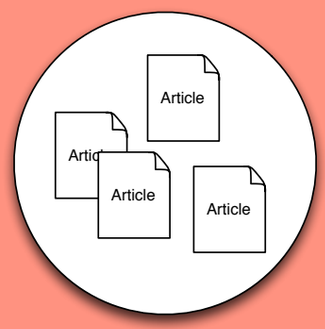


Nokia Lumia 920

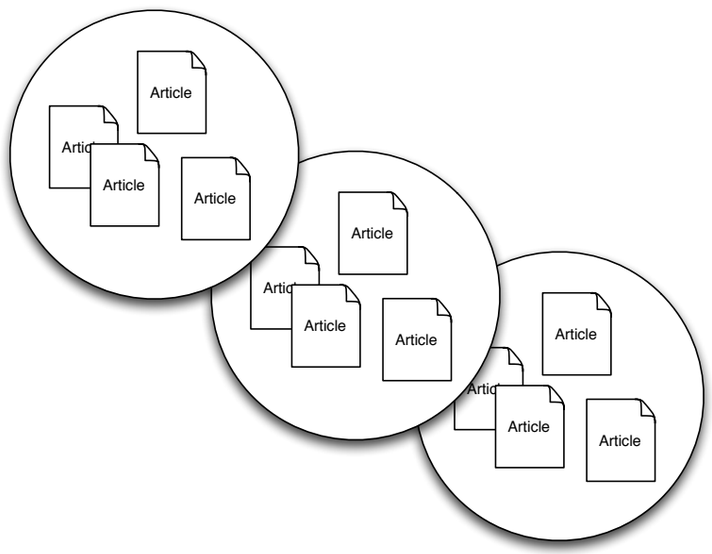
Technology

Data Set

- Made use of dataset from guided summarization task of TAC 2010/2011
- Sets of articles to be summarized grouped into topics
- Topics are grouped into categories

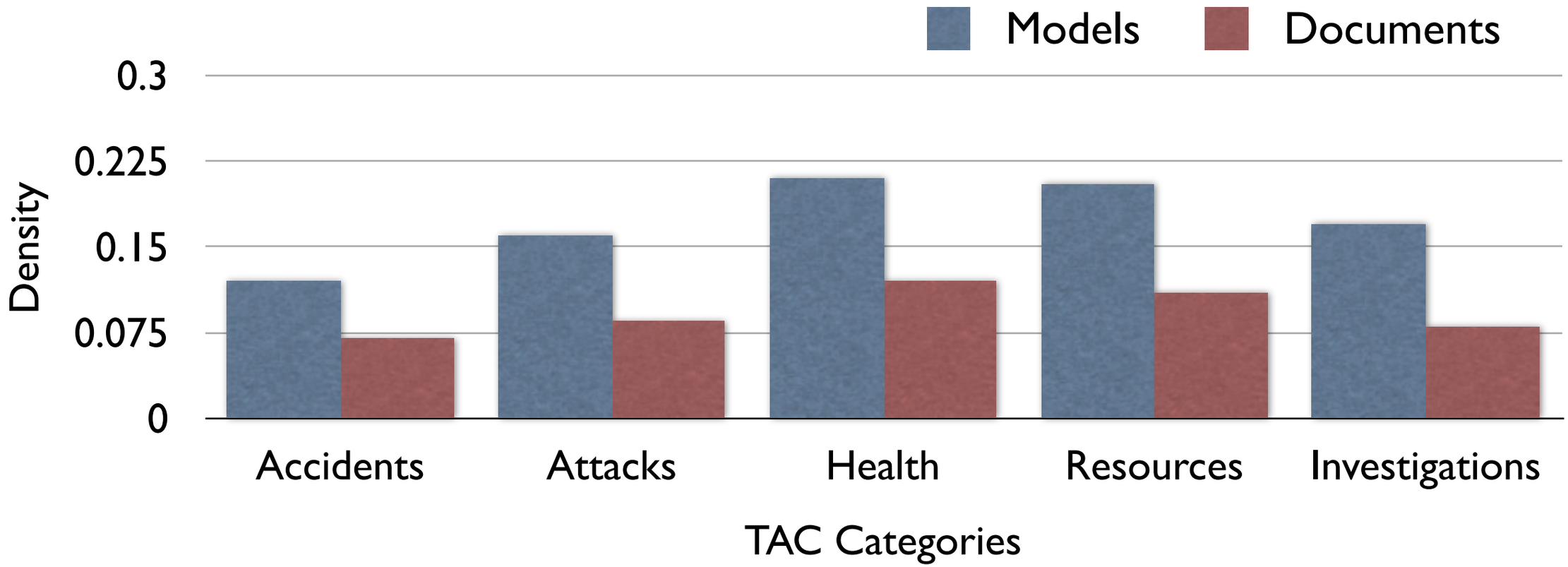
TAC Categories

- Accidents and Natural Disasters
- Attacks
- Health and Safety
- Endangered Resources
- Investigations and Trials



Justifying Our Intuition

- Words with high log-likelihood ratios are used more frequently inside model summaries



Category Relevance (CRS)

- **Importance** of a **word** with respect to a **category**

$$CRS_c(s) = \frac{\sum_{w \in s} (\beta \times TLF_c(w) + (1 - \beta) \times DLF_c(w))}{|s|}$$

Topic Frequency Score

Document Frequency Score

Category KLD (CKLD)

- Measure of **divergence** of probability **distribution** of a word in a **category**, with respect to the whole **collection**

$$CKLD_c(s) = \sum_{w \in s} \left(p_c(w) \times log \frac{p_c(w)}{p_C(w)} \right)$$

Probability of word in category

Probability of word in collection

Top Words

CRS	CKLD
official	crane
people	bridge
report	construction
news	java
accident	people

For articles on “Accidents”

Summarization Results

- Category-specific features give significant performance enhancement

System	ROUGE-2	ROUGE-4
Generic + CRS + CKLD	0.13796	0.16808
Generic + CRS	0.13702	0.16788
Generic + CKLD	0.13525	0.16649
CLASSY	0.12780	0.15812
POLYCOM	0.12269	0.15974

✣ ROUGE measures on TAC 2011 testing set

Less than Perfect Categorization

- In more realistic scenarios, perfect categorization is hard to come by
- Would our proposed CSI still be effective if we don't have perfect categorization?

Categorization Experiments

- Perfect clustering information is not essential

System	ROUGE-2	p-value
* Perfect Categories	0.13796	-
EM Clustering	0.13647	0.154
X-Means Clustering	0.13546	0.117
K-Means Clustering	0.13569	0.365

✣ Scores reported for 5 clusters

Analysis

Baseline

- The death toll could rise as thousands are still buried in debris and many are reported missing.

- Therefore, the relevant sectors and personnel should pay attention to disaster prevention.

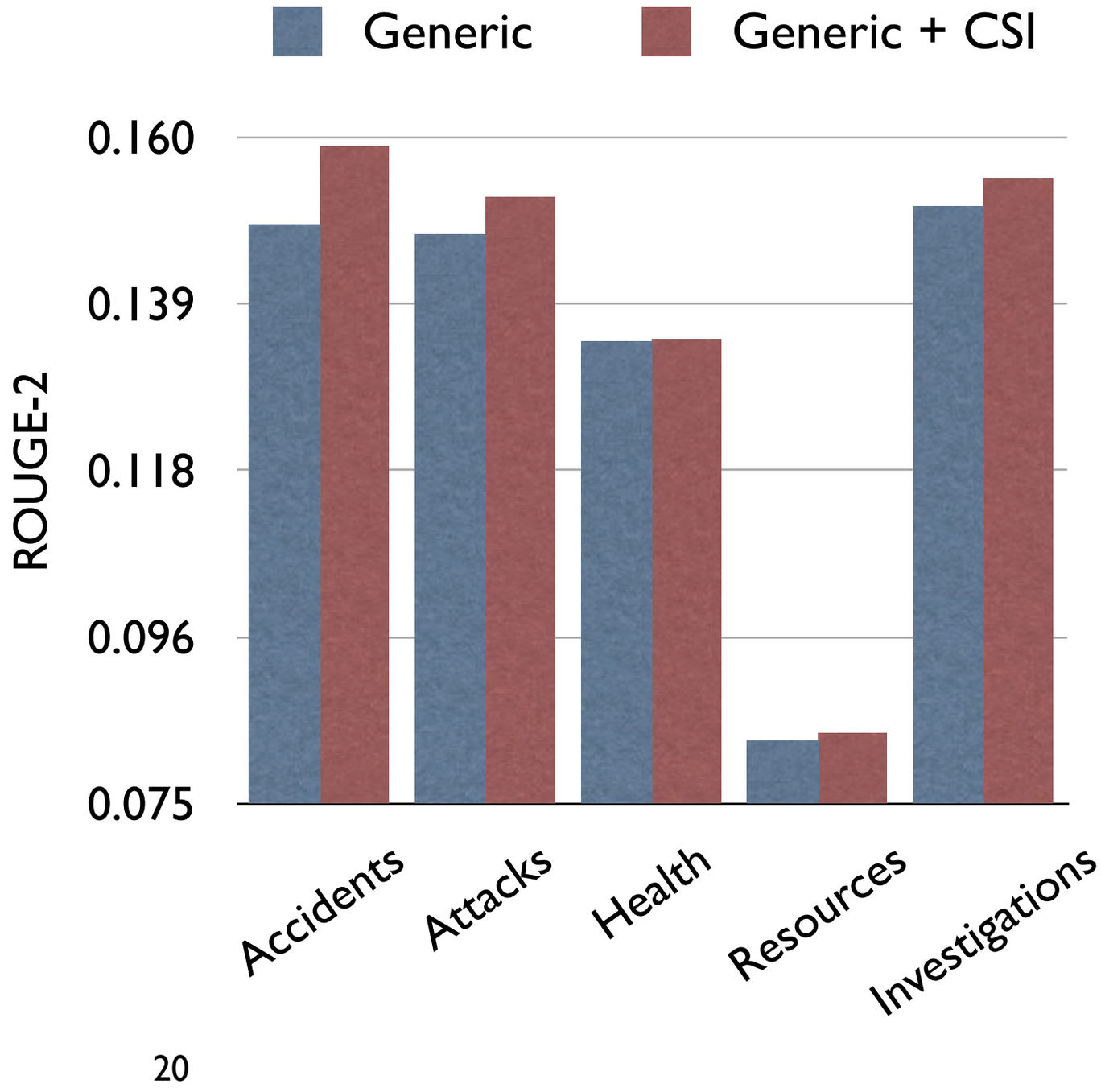
Generic + CRS + CKLD

+ Chinese authorities did not detect any warning signs ahead of Monday's earthquake that killed more than 8,600 people.

+ Xinhua said 8,533 people had died in Sichuan alone, citing the local government.

Varying Difficulties

- Some categories are easier to improve on
- Category-specific features help more with the WHO, WHAT, WHEN, WHERE



Round Up

- Category-specific information (CSI) can help multi-document summarization
- Effective in improving content selection
- Robust and is useful even when less than ideal categorization results are available

Thank you!

Questions?

You can download the system here:
http://wing.comp.nus.edu.sg/downloads/swing/