Sequential Clustering and Contextual Importance Measures for Incremental Update Summarization

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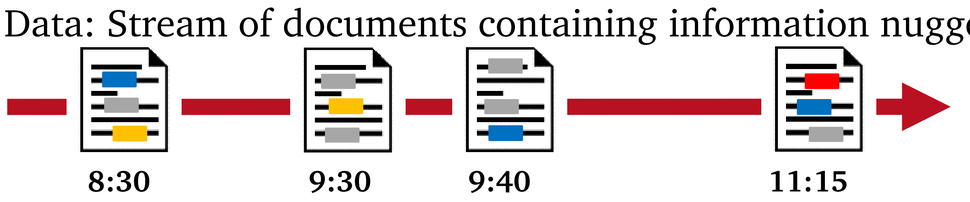
SeqCluSum in a nutshell

- incremental update summarization
- combine benefits of pipeline and clustering approaches
- model importance and redundancy jointly with contextual cluster ranking
- best results on TREC-TS dataset

Incremental Update Summarization

Data: Stream of documents containing information nuggets

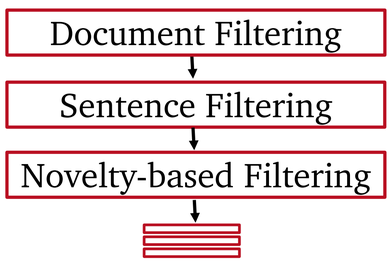


= On 16 January 2013,at around 0800 GMT
= A helicopter crashed into a construction crane in Vauxhall
= Captain Pete Barnes and a pedestrian, Matthew Wood, died

Task: Find new & important information nuggets as soon as possible
Application: developing events such as accidents, natural disasters, elections, etc.

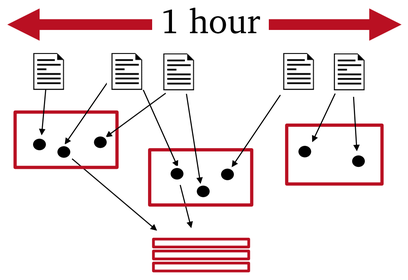
Clustering Information with Sequential Clustering

Pipeline



+ timely & - poor decisions

Clustering



- delayed & + good decisions

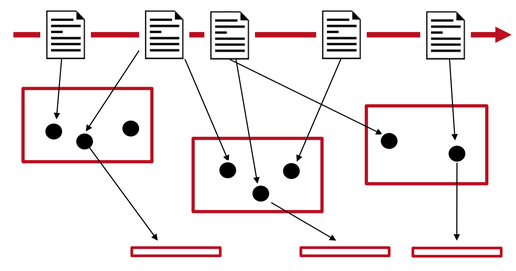
prior work used either pipeline or clustering

Idea: combine benefits of both approaches

1. be able to publish information at any time
2. use clustering to detect new and important information

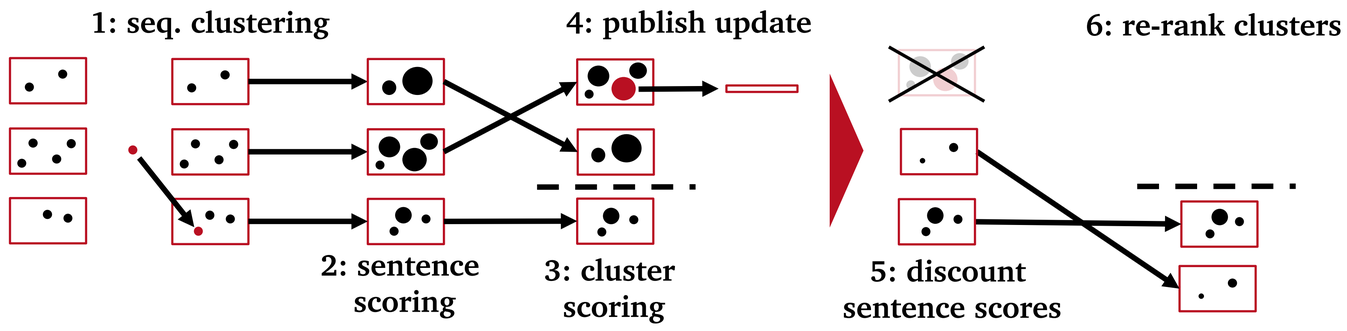
→ natural fit for IUS

Sequential Clustering



+ timely & + good decisions

Publishing Updates with Contextual Cluster Ranking

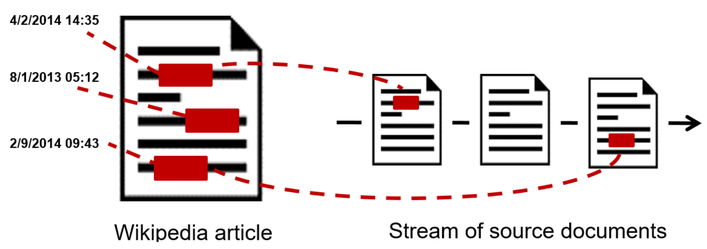


new document/sentence is available in the web:

1. **seq. clustering**: assign sentence to nearest cluster or create new cluster if distance is too big
2. **sentence scoring**: estimate sentence importance (high temporal TF-IDF → more important)
3. **cluster scoring**: cluster score based on sentence scores (bigger cluster → more important)
4. **publish update**: if a cluster is important enough → emit best sentence from cluster
5. **discount sentence scores** for redundancy avoidance
   (sentence similar to published sentence → larger discount)
6. **re-rank clusters** according to new sentence scores

Evaluation Dataset

- dataset from TREC-TS 2015 shared task
- based on webpage snapshots + Wikipedia revision history



- trace driven simulation to evaluate systems
- only small subset of sentences labeled due to high annotation effort
  → only lower bound evaluation ☹

Results

Type	System	$\mathcal{H}$	Timeliness	F_1(Prec, Rec)	Precision	Recall
Seq. clustering	SeqCluSum (lower bound)	**0.1526**	**0.8013**	**0.1842**	0.1485	0.2426
Pipeline	Raza, 2015; 1st@TREC-TS '15	0.0853	0.3983	0.1773	0.1840	0.1710
Clustering	McCreadie, 2015; 3rd@TREC-TS '15	0.0639	0.5335	0.1189	0.0667	0.5459
Pipeline	McCreadie, 2015	0.0508	0.6741	0.0758	0.0402	0.6590

$\mathcal{H}$: combination of Timeliness, Precision, and Recall
Timeliness: estimates timeliness of updates; 1=on time with ground truth, 0=outdated
Precision: fraction of important & novel system updates
Recall: fraction of information nuggets covered by system updates

Conclusions

→ SeqCluSum achieves **high $\mathcal{H}$** result derives from **both high timeliness** and **high F1 scores**

→ **combination** of **pipeline** and **clustering** works well for incremental update summarization

→ could be further improved with **prior knowledge** about information importance

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