

Automatic Single-Document Key Fact Extraction from Newswire Articles

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EACL 2009

The Task: CNN.com Story Highlights

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PimpThisBum.com employs irony on homeless man's behalf

STORY HIGHLIGHTS

- Father-son team launch PimpThisBum.com as stunt to help homeless man
- Homeless man, Timothy Edwards, has received more than \$50,000 in donations
- Edwards: "To everybody that thinks I am being exploited, I ask you to think again"
- "This isn't a good strategy to address the problem of homelessness," critic says

[Next Article in U.S. »](#)

Thirty years later, Sadat's widow still hopes for peace

STORY HIGHLIGHTS

- Thirty years after the Camp David accords, Anwar Sadat's widow hopes for peace
- Jehan Sadat's husband was assassinated two years after the treaty signing
- She says Islam is a religion of peace and the people of the Mideast want peace

[Next Article in World »](#)

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Highlight Sources in Various Points in the Text

Americans celebrate, honor the fallen on Memorial Day

POSTED: 6:09 p.m. EDT, May 28, 2007



A skydiver carries an American flag as he descends into Folsom Field during a celebration in Boulder, Colorado.

ADVERTISER LINKS

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[Bush marks Memorial Day](#) (0:02)



[Wreath laid at Tomb of the Unknowns](#) (3:00)



[Sights and sounds of Memorial Day weekend](#) (1:16)



[Rolling Thunder rumbles in Washington](#) (1:20)

STORY HIGHLIGHTS

- Memorial Day marked by parades, cookouts, ceremonies
- AAA: 38 million Americans expected to travel at least 50 miles during weekend
- President Bush gives speech at Arlington National Cemetery
- Gulf Coast once again packed with people celebrating holiday weekend

Adjust Size:  

NEW YORK (AP) -- Veterans and active soldiers unfurled a 90-by-100-foot U.S. flag as the nation's top commander in the Middle East spoke to a Memorial Day crowd gathered in Central Park on Monday.

Navy Adm. William Fallon, commander of U.S. Central Command, said America should remember those whom the holiday honors.

"Their sacrifice has enabled us to enjoy the things that we, I think in many cases, take for granted," Fallon said.

Across the nation, flags snapped in the wind over decorated gravestones as relatives and friends paid tribute to their fallen soldiers. [\(Watch the sights and sounds of Memorial Day weekend\)](#)

Millions more kicked off summer with trips to beaches or their backyard grills.

AAA estimated 38 million Americans would travel 50 miles or more during the weekend -- up 1.7 percent from last year -- even with gas averaging \$3.20 a gallon for self-service regular.

In the nation's capital, thousands of motorcycles driven by military veterans and their loved ones roared through Washington to the Vietnam Veterans Memorial. It was the 20th year the group, Rolling Thunder, has taken to the streets of the nation's capital in support of U.S. military members past and present.

President Bush spoke at nearby Arlington National Cemetery, honoring U.S. troops who have fought and died for freedom and expressing his resolve to succeed in the war in Iraq. [\(Watch President Bush pay tribute to the troops\)](#)

"From their deaths must come a world where the cruel dreams of tyrants and

terrorists are frustrated and foiled -- where our nation is more secure from attack, and where the gift of liberty is secured for millions who have never known it," the president said.

Helen Velasquez stood over her husband's grave in Farmington, New Mexico, and said he never second-guessed his decision to enlist in the Marines. Frank Velasquez, 47, was disabled and died in March.

"I think a lot of people don't think of it until someone they love passes away," she said. "Sometimes I feel they're forgotten. I want them to know they're never forgotten."

A Memorial Day tribute at Brooklyn's Green-Wood Cemetery was marked with 1,200 new gravestones for Civil War veterans whose graves were recently rediscovered after a nearly five-year search. The cemetery, founded in 1838, is the burial place of nearly 600,000 people, including veterans from every American war, said Richard J. Moylan, its president.

At Fort Bragg, North Carolina, the commanding general of the Army's Green Berets said the troops who have died around the world were "soldiers we could count on when the going got tough." Thirteen Green Berets who died during the past year were honored as were 109 former Green Berets who died during the period. [\(Watch soldiers hold ceremonies for lost comrades in Iraq\)](#)

"We always could count on our Special Forces brothers to be there with us, regardless of the odds against us," Maj. Gen. Thomas R. Csmko said at a ceremony at the headquarters of the Army's Special Forces Command.

Elsewhere, Alabama's Gulf Coast was once again packed with holiday-goers after the damage from hurricanes Ivan and Katrina in 2004 and 2005 kept the tourists away.

"It couldn't have been better -- use all the superlatives you want," said Johnny Fisher, general manager of Lucy Buffett's Lulu's at Homeport Marina in Gulf Shores. "It was all perfect."

The Task: CNN.com Story Highlights

- The Story Highlights are written by a human editor.
- Encapsulate the most important pieces of knowledge in the article.
- Culled from various points in the text.
- How can we create these Highlights automatically?
- **AURUM**: Automatic Retrieval of Unique information with Machine learning.

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Svore et al. (2007)

- *Enhancing Single-Document Summarization by Combining RankNet and Third-Party Sources*
- Encouraging ROUGE results: +6% for unigram recall, +3% for bigram recall
- Neural networks used for ranking
- Extract exactly 3 Highlights from every article
- 2nd experiment: try to match the order as well

External Data

- Microsoft Live News search logs
- Wikipedia articles

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Determine Features

- 1 Inspect the training set and see what the characteristics are
- 2 Use additional features already existing in summarization and IR
- 3 Infer other features statistically
- 4 Assign a weight to each feature using machine learning

Score Sentences

- 1 For a given article, score each sentence against the features

$$\sigma(s) = w_{pos}p_{pos(s)} + \sum_{k=1}^n w_k f_k + \sum_{j=1}^{|s|} \sum_{k=1}^m w_k g_{jk}$$

- 2 Rank sentences by score
- 3 Use top n sentences as Highlights
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Sentence Features Evaluated per Sentence

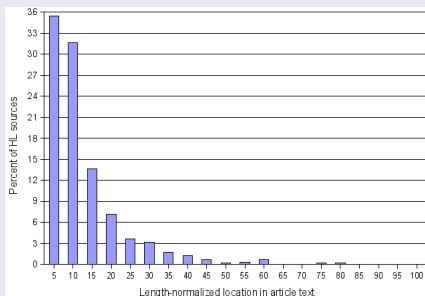
Sentence Position

Sentence position score

$$p_i = 1 - (\log i / \log N)$$

i – position of the sentence in the article

N – total number of sentences in the article



Temporal Adverbs

- Simple temporal descriptors, the kind used in previous summarization work: *Thursday*
- Longer phrases which are typical to the training data: *after less than, for two weeks*

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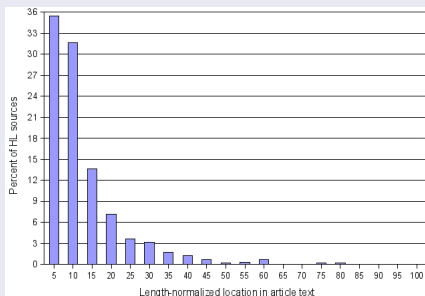
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Proper Nouns

Mention of a person or organisation as an indicator of important or new information (using Charniak's parser)

Verb Groups

- Types of verbs which appear often in the website's journalistic writing
- TalkVerbs: *report, mention, accuse*
- ActionVerbs: *provoke, spend, use*

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n-gram Frequency in Article and Highlights

Frequency and probability of unigrams, bigrams and trigrams appearing in both the article body **and** the highlights of a given story.

Trigger Phrases and Spawned Phrases

- Trigger Phrases: cause adjacent words to appear in the Story Highlights, e.g. the word according triggered neighbouring words in 1 out of every 4 appearances
- Spawned Phrases: appear in the Highlights **and** next to Trigger Phrases
 - **Highlight (spawned):** 61 PERCENT OF THOSE POLLED NOW SAY IT WAS NOT WORTH INVADING IRAQ, POLL SAYS
 - **Source (trigger):** NOW, 61 PERCENT OF THOSE SURVEYED SAY IT WAS NOT WORTH INVADING IRAQ, ACCORDING TO THE POLL.
- Further augmented with WordNet by using the synsets

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Training Set and Development/Test Set

Corpus subset	Dev/Test	Train
Documents	300	1220
Avg. sentences per article	33.26	31.02
Avg. sentence length	20.62	20.50
Avg. number of highlights	3.71	3.67
Avg. number of highlight sources	4.32	-
Avg. highlight length in words	10.26	10.28

Development/Test set used five-fold cross-validation due to small number of manually annotated articles.

Machine Learning of Feature Weights

- 1 YASMET, a maximum entropy classifier, was used to automatically learn feature importance
- 2 Highlight Sources were manually annotated in 300 articles (the development/test set)
- 3 In each of the five folds, YASMET determined weights for the different features anew
- 4 The weights were used for the test set of the relevant fold

Results: Recall, Precision, F-Measure

System	Recall	Precision	F-Measure
Baseline-fixed	40.69	44.14	42.35
AURUM-fixed	41.88 (+2.96%*)	45.40 (+2.85%)	43.57 (+2.88%*)
Baseline-thresh	42.91	41.82	42.36
AURUM-thresh	44.49 (+3.73%*)	43.30 (+3.53%)	43.88 (+3.59%*)

- AURUM-fixed: always returns 4 sentences
- AURUM-thresh: returns between 3 and 6 sentences according to a threshold learned automatically from the development data
 - Anywhere between 1 and 7 sentences as Highlight Sources in an article – usually between 3 and 6
 - Therefore, impossible to know in advance how many Highlight Sources needed
 - Threshold learned from the development set and then used on the test set
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Results: ROUGE-1, ROUGE-2 (Recall Metric)

System	ROUGE-1 (unigrams)	ROUGE-2 (bigrams)
Baseline-fixed	47.73	15.98
AURUM-fixed	49.20 (+3.09%*)	16.53 (+3.63%*)
Baseline-thresh	55.11	19.31
AURUM-thresh	56.73 (+2.96%*)	19.66 (+1.87%)

- ROUGE: Recall-Oriented Understudy for Gisting Evaluation
- Current standard evaluation metric for automatic summarization
- ROUGE-N =

$$\frac{\sum_{S \in \text{References}} \sum_{ngram_n \in S} Match(ngram_n)}{\sum_{S \in \text{References}} \sum_{ngram_n \in S} Count(ngram_n)}$$

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Individual Feature Importance

Feature	Weight	Feature	Weight
Sentence position	10.23	Spawn 2-gram	3.73
Proper noun	5.18	Trigger 3-gram	3.70
Superlative	4.15	1-gram score	2.74
3-gram score	3.75	Temporal adjective	1.75
Trigger 2-gram	3.74	Mention of CNN	1.30

Conclusions

- Combination of features
 - Structural: sentence position
 - Word-class: proper nouns, word groups
 - Lexical frequency
- Feature weights learned by machine learning techniques
- Limited use of external resources
- AURUM outperforms a simple yet robust baseline
- Linguistic features are useful and comparable to external data sources
- Annotated data set available soon at the following URL:
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Americans celebrate, honor the fallen on Memorial Day

Posted: 6:33 p.m. EDT, May 28, 2007



A soldier carries an American flag on the grounds of Fort Bliss during a celebration in El Paso, Colorado.

ADVERTISER LINKS

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VIDEO

[Bush marks Memorial Day](#) (1:02)

[Wagon load of Tanks at The Airpocets](#) (1:00)

[Riffs and sounds of Memorial Day](#) (1:14)

[Riding Thunder on the Coast](#) (1:20)

STORY HIGHLIGHTS

- Memorial Day marked by parades, concerts, ceremonies
- AAA, 30 million Americans expected to travel at least 50 miles during weekend
- President Bush gives speech at Arlington National Cemetery
- Gulf Coast once again packed with people celebrating holiday weekend

AP/WIDEWORLD (1)

NEW YORK (AP)—Veterans and active soldiers embarked a 90-by-100-foot U.S. flag on the nation's top commander in the Middle East spoke at a Memorial Day crowd gathered in Central Park on Monday.

Navy Adm. William Fallon, commander of U.S. Central Command, said America's proud servicemen have shown the holiday's best.

"Their sacrifice has enabled us to enjoy the things that we, I think in many cases, take for granted," Fallon said.

Across the nation, flags waved in the wind over the scattered graveyards as relatives and friends paid tribute to their fallen veterans. [Watch the sights and sounds of Memorial Day weekend.](#) (1:18)

Millions more looked at summer with tips to beaches as their backyard gets.

AAA estimated 30 million Americans would travel 50 miles or more during the weekend—up 17 percent from last year—most with gas averaging \$3.20 a gallon for its favorite regions.

In the nation's capital, thousands of motorcycles drove by military veterans and their loved ones lined through Washington in the Vietnam Veterans Memorial. It was the 25th year the group, Riding Thunder, has taken to the streets of the nation's capital in support of U.S. military members past and present.

President Bush spoke at nearby Arlington National Cemetery, honoring U.S. troops who have fought and died for freedom and exposing his wishes to support of the war in Iraq. [Watch President Bush give tribute to the brave.](#) (1:18)

"From their deaths must come a world where the civil demands of justice and

freedom are nurtured and filled—where our nation is more secure than attack and where the life of liberty is secured for millions who have never known it," the president said.

Helen Velazquez died over her husband's grave in Farmington, New Mexico, and said he never second-guessed his decision to enlist in the Marine. Frank Velazquez, 47, was disabled and died in March.

"I think a lot of people don't think of it until someone they love passes away," she said. "Sometimes that brings together, I mean there is been that's never forgotten."

A Memorial Day tribute at Bowdoin's Green-Wood Cemetery was marked with 1,200 new graveyards to Civil War veterans whose graves were recently rediscovered after a nearly five-year search. The cemetery, founded in 1836, is the final home of nearly 800,000 people, including veterans from every American war, said Richard J. Moyle, its president.

At Fort Bragg, North Carolina, the commanding general of the Army's Green Berets said the troops who have died around the world were "not men we could count on when the going got tough." Vietnam Green Berets who died during the past year were honored as were 100 former Green Berets who died during the year. [Watch soldiers hold ceremonies for last comrades in Iraq.](#) (1:18)

"We always could count on our Special Forces brothers to be there with us, regardless of the odds against it," Maj. Gen. Thomas R. Gorman said at a ceremony at the headquarters of the Army's Special Forces Command.

Elsewhere, Alaska's Gulf Coast was once again packed with holidaygoers after the damage from hurricanes Ivan and Katrina in 2004 and 2005 kept the tourists away.

"It couldn't have been better—see all the opportunities you have," said Johnny Fisher, general manager of Lucy Buffett's Luau's at Homespun Marine in Gulf Shores. "It was all perfect."

Thank you!

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