Broadcast News Navigator (BNN) Demonstration

Mark Maybury
Information Technology Division
The MITRE Corporation
202 Burlington Road
Bedford, MA 01730, USA
mavbury(a),mitre. org
www, mitre. or2/resources/centers/it

Summary

The Broadcast News Navigator (BNN) is a fully implemented system that incorporates image, speech, and language processing together with visualization and user preference modeling to support intelligent, personalized access to broadcast news video. The demonstration will illustrate the use of the system's underlying machine learning enabled story segmentation and processing, called the Broadcast News Editor (BNE). A live, scenario-based demonstration will illustrate the use of named entity search, temporal visualization of entities, story clustering and geospatial story visualization, discovery of entity relations, and personalized multimedia summary generation. By transforming access from sequential to direct search and providing hierarchical hyperlinked summaries, we will demonstrate how users can access topics and entity specific news clusters nearly three times as fast as direct search of digital video. In short, we will demonstrate intelligent news on demand enabled by a suite of AI technologies.

1 Intelligent Segmentation

Fundamental to BNN is the exploitation of text, audio, and imagery streams and associated cues which are used to detect story and commercial segment boundaries and to select media elements to use for summaries and multimodal displays. We will demonstrate how certain cross media cues such as language content (e.g., frequent weather or sports terms, funding and/or copyright notices), discourse cues (e.g., "coming up next"), music (e.g., characteristic jingles), silence indicating breaks to commercial, and visual cues (e.g., logos, anchor booth vs report shots) help signal program start/end, anchor/report shots, commercials, and/or story shifts. Underlying BNN is a set of machine learned, time-enhanced finite state automata modeling news structure that take into account the above cues and probabilistic, temporal models of event occurrence [Boykin and Merlino, 2000].

2 Named Entity Search and Retrieval

BNN supports the retrieval of stories based on user query, either keyword, named entity, or topics. For example, the user can specify source, date ranges, keywords, subjects, or named entities. As show in Figure 1, after selecting news programs (e.g., CNN NewsNight, ABC World News Tonight, Fox News) and indicating date ranges (in this case January 6-9, 2003), a user can simply type in keywords in the text box (e.g., "Korean weapons of mass destruction"). In addition, if a user is unfamiliar with retrieval terms, they can display an alphabetic listing of all the named entities extracted for the time period and from the programs of interest, such as shown in the person, organization, and location searchers in Figure 1. Note the evidence of information extraction errors such as "English" under location or "reserve" under organization. We will demonstrate how information extraction [Aberdeen et al., 1995] on noisy data such as closed caption or speech transcription (as opposed to less errorful newswire text) drops from about 90% precision and recall to about 70-80%.

If the user selects "North Korea" in Figure 1, they are provided access to the 39 stories detected during the week, as presented in the "Story Skim" display shown in the left of Figure 2. In this case the system shows the source and date, the top 3 named entities in each story, and a representative key frame from each selected segment extracted using heuristics based one the type of story segment (e.g., anchor, reporter, interview). Note the stories range from several sources (CNN, CNN Money Line, CNN NewsNight with Aaron Brown), dates, and times of day. The media elements used in "story skim" and "story details" were selected after careful empirical study of the optimal combination of multimedia elements for video retrieval and extraction tasks [Merlino and Maybury, 1999], The current system [Maybury 2003] allows the user to interactively customize these to their preference.

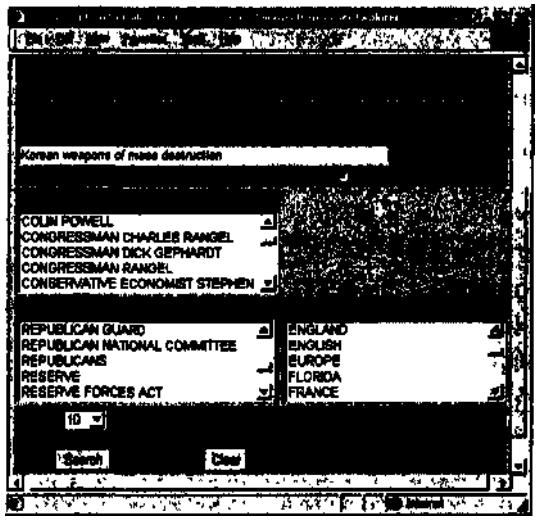

Figure 1. Text and Named Entity Search Menus

Figure 2. January 2003 North Korean "Story Skim'* and "Story Details"

3 Relevancy Feedback

Users can navigate directly from the Story Skim of Figure 2 on the left to a "Story Details** display as shown on the right. "Story Details" include the key frame, one line summary (the story line containing the most named entities), all extracted named entities, and pointers to video source, transcript, and relevant stories. The user can either review the story or engage in further query refinement, accomplished with an underlying Local Context Analysis (LCA) algorithm.

4 Visualization and Discovery

As shown in Figure 3, users can visualize named entity frequencies by collection, source, or date range, visualize temporal occurrences, and display story occurrences associated with geospatial regions, animated over time. Finally, users can interactively run data mining algorithms to discover relationships among named entities (e.g., people associated with locations or organizations), and automatic detection of topic clusters. In addition, users can set profiles that specify their media (e.g., text summary, image key frames, summary), and navigation preferences (e.g., overviews or not, links to related stories). We demonstrate live how BNN users can find video stories and answer questions about two to three times as fast as with original sources, with no performance loss.

Figure 3. Entity and Trend Analysis; Geospatial Display

Acknowledgments

BNN is the product of numerous contributors including Stanley Boykin, Andy Merlino, Warren Grieff, Jay Ponte, Chris Clifton, and Chad McHenry.

References

[Aberdeen et al., 1995] Aberdeen, J., Burger, J., Day, D., Hirschman, L., Robinson, P., and Vilain, M. 1995. Description of the Alembic System Used for MUC-6. In Proceedings of the Sixth Message Understanding Conference, 141-155. ARPA/ITO, 6-8. Columbia, MD.

[Boykin and Merlino, 2000] Boykin, S. and Merlino, M. Feb. 2000. A. Machine learning of event segmentation for news on demand. *Communications of the ACM.* Vol 43(2): 35-41.

[Merlino and Maybury, 1999] Merlino, A. and Maybury, M. 1999. An Empirical Study of the Optimal Presentation of Multimedia Summaries of Broadcast News. Mani, I. and Maybury, M. (eds.) *Automated Text Summarization,* MIT Press.

[Maybury 2003] Maybury, M. 2003. Broadcast News Understanding and Navigation. Innovative Applications of Artificial Intelligence. Acapulco, Mexico. 12-14 August, 2003