

VideoTag

Multimodal Annotation, Summarization, and Inference

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Goals

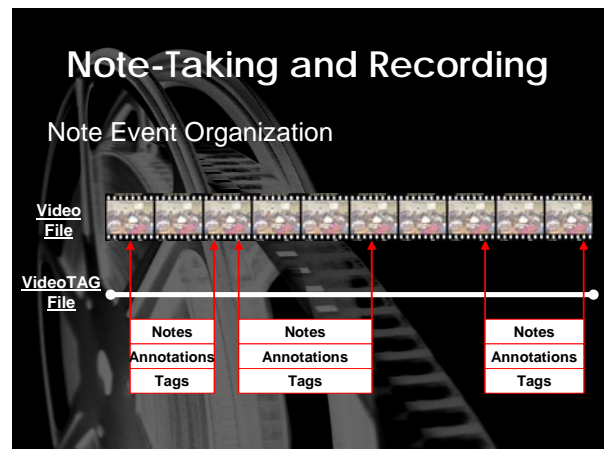
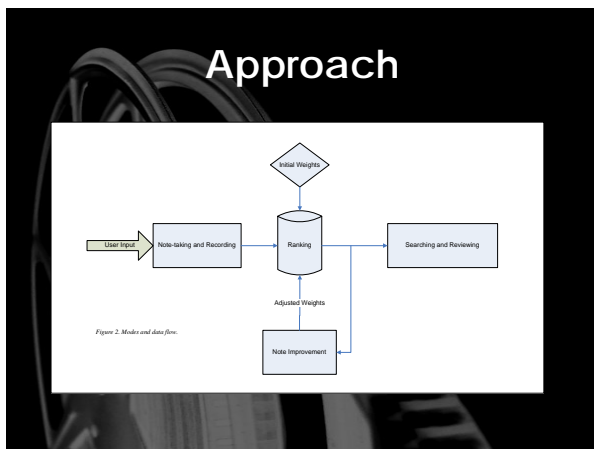
- Note-taking system
 - Using Tablet PC
 - Personalized and intuitive
- Note review system
 - Search
 - Summary
- Note improvement
 - Semi-automatic
 - Discovery of inconsistencies

Challenges

- What other programs are lacking:
 - Video-centric organization
 - Organization with personalization
 - Search and Summarization

Approach

- Develop an application that uses summarization and suggestion to improve upon the current model of Tablet PC-based educational tools.

Live Demonstration

- Annotating
- Searching
- Reviewing

Ranking

- Needed in order to summarize the information
- Score determined by the three note components: ink, text, and tags

Ranking

- Individual Ranking Calculation:

$$I_I = k_1 \cdot w \cdot h + k_2 \cdot (\# \text{ strokes})$$

$$I_w = (\# \text{ chars})$$

$$I_T = \sum_i T_w(t_i)$$

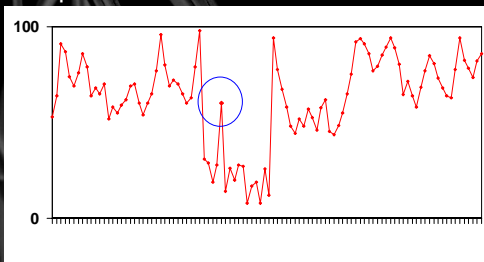
- Note event raw score is average of these values

Ranking

- Raw score is not helpful over long-term because certain things can change:
 - Note-taking style
 - The amount of information covered in class
- As a result, summary of top n events would be lopsided

Adjustment

Example local maximum



Adjustment

- Instead, rate score over a rolling window w using SNR
 - Examine a set of events $w/2$ time in either direction from the concerned event
 - Signal-to-noise ratio N is:

$$N = 20 \log \frac{E}{A_w}$$

- Where E is the raw score and A_w is the average score from the set of raw scores of all the events in the window w .

Improvement

- What if summaries are not acceptable to the user?
- Predefined parameters like w are somewhat arbitrarily chosen, but may not supply satisfactory summaries to the user
- User must be able to supply feedback in order to allow some "flexibility" of ranking algorithm and personalize the summarized output

Improvement

- Note improvement
 - When reviewing a list of summarized events that have been marked as important, the user can manually flag an event as not belonging in the summary.
 - In order to continue using the ranking algorithm, the parameters w , $k_{1,2}$, and $c_{1,2,3}$ must be changed

Improvement

- Solution:
 - Separate events that have been marked important and events that must be not important into two sets, E_i and E_j .
 - The function:
$$f(k, c, w) = \sum_{i=1}^n (E_i(k, c, w) - M(w))^2 + \sum_{j=1}^m (E_j(k, c, w) - 0)^2$$
can be used for a "least squares" type optimization with the parameters k , c , and w and data consisting of the note events and previous correctly-generated summaries

Improvement

- Solution (cont):
 - The optimization function boils down to a system of equations which will be over constrained assuming a reasonable set of note events, so an approximate solution can be determine

What's next?

- Implement the ranking and summarization
- Testing phase planned for Fall 2006
 - Record CS251 (Data Structures) lectures
 - Have students annotate lectures, give feedback