diveXplore Sketch Search at the Video Browser Showdown 2018 – Final Notes

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ABSTRACT

This short paper presents the diveXplore sketch search component, developed as an extension to the continuously evolving diveXplore system and used at the annual Video Browser Showdown (VBS). The integrated sketch search constituted the basis for entering a second Alpen-Adria University (AAU) team, ITEC2 at the VBS2018. By way of this short paper we intend to account for last minute changes not included in the submitted VBS2018 challenge paper [1] as well as give details about the system's usage during the challenge.

KEYWORDS

video browser showdown, evaluation campaign, ad-hoc video search

1 SYSTEM OVERVIEW

Klagenfurt University's continually developed *distributed interactive video exploration* (diveXplore) system offers a variety of features for fast content retrieval in large video databases, such as the TRECVID IACC.3 used for the 2018 VBS challenge. Among various browsing, filtering and retrieval functionalities [3], team ITEC2 developed a *sketch search* extension component allowing the user to roughly draw a desired scene that can be entered into the system as a query for color-based shot keyframe retrieval (cf. Figures 1, 2).

For performance reasons sketch creation is restricted to a reduced color palette and keyframe matching is conducted in a patch-wise manner across images. Finally, employing pivot table indexing [2] allows for efficiently narrowing down results enabling reasonable search durations. Hence, all of the features' properties can be summarized as:

- hand-drawn sketching
- reduced color palette (18 colors)
- custom descriptor matching (*HistMap*)
- pivot table lookup using pre-calculated keyframe descriptors

2 FINAL SYSTEM CHANGES

Initially intended as a two-step process – pre-filtering results via color composition and refining them using contour matching techniques – as described in [1], the final system proved to be more efficient disregarding the much too computationally expensive second step, which, thus, has been removed for VBS2018.

At the core of remaining step 1 the custom-made *HistMap* descriptor is used for result matching. HistMap is a histogram-based pixel color mapping using a fixed set of 18 colors. It is calculated in an overlapping sliding window fashion across an image yielding a total of 25 histograms, i.e a feature vector in $\mathbb{R}^{450}$ (25×18 values). Since diveXplore retrieval is video shot based using single frames as shot summarizations, this descriptor is pre-calculated for each of those so-called *keyframes*.

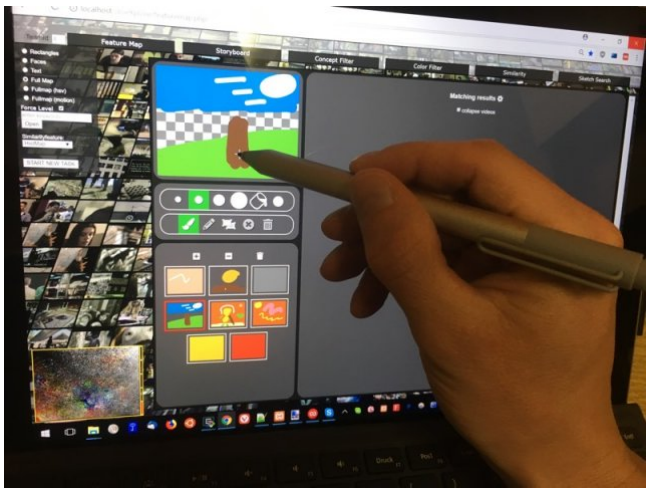

Fig. 1: *Sketch Search* enables users to draw roughly a desired scene for retrieval using the custom developed color-based *HistMap* descriptor. This image demonstrates the sketching functionality on a pen-enabled tablet.

Fig. 2: Retrieved results using *HistMap* descriptor as basis for sketch search.

Furthermore, in order to achieve acceptable retrieval performance, HistMap similarity search is performed via pivot table

lookup using the Nearest-Neighbor Approximating and Eliminating Search Algorithm [2], which is as well utilized for matching optimization other descriptors integrated into diveXplore.

Lastly, while similarity search can be performed using any of the keyframes when browsing, the sketching interface, however, is realized within a separate tab, similarly to other diveXplore features not involving feature maps. For all painting functionality, popular JavaScript canvas library fabric.js [4] is utilized.

3 SYSTEM USAGE AT VBS2018

The sketch search interface, as shown in Figure 1, provides the user with an initially transparent canvas, some drawing controls and a history containing previously drawn sketches. The matching results (Figure 2) area on the right side constantly is updated upon changing the sketch canvas in order to quickly present the user with feedback on how the current color composition is matched internally.

Since diveXplore offers much more functionalities than just sketch search, the system usage during the challenge differed depending on user (expert/novice) as well as task type – Known Item Search (KIS) textual/visual, Ad-hoc Video Search (AVS). Naturally, the extension is most suited for KIS visual because this task already demonstrates how the target scene looks like – artists merely have to guess the composition of corresponding keyframes. Nevertheless, sketch search seems as well to be useful in some KIS textual tasks, in particular when object colors contained in the target scene are described. Finally, in AVS tasks drawing sketches is simply much too slow to be competitive in VBS, although it can prove useful when utilized as a similarity measure using existing keyframes.

Above realizations can as well be observed when regarding expert and novice users during the challenge. However, while expert users used sketch search to their advantage when suitable, novices far less familiar with the system's features understandably restricted themselves to more easy-to-use features, such as textual search and used sketch search only on occasion – even for KIS visual tasks.

4 CONCLUSIONS

It is difficult to merely focus on a single component (sketch search) of a much bigger system (diveXplore), especially since it is developed with versatility in mind. Experiences at the VBS2018 have shown that in certain situations it can be useful to use sketch search, yet, it should probably be disregarded when it comes to tasks like AVS, where multiple fast submissions are required. However, in conclusion sketch search indeed constitutes a valuable addition to the system, rendering it even more diverse and as well entertaining to use.

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