



Image Rearrangement & Video Synopsis

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Abstract

Two topics involving image and video rearrangement will be covered, with applications for image editing and for video summarization.

(a) Geometric rearrangement of images includes operations such as image retargeting, object removal, or object rearrangement. Each such operation can be characterized by a shift-map: the relative shift of every pixel in the output image from its source in an input image. We describe a new representation of these operations as an optimal graph labeling, where the shift-map represents the selected label for each output pixel. Two terms are used in computing the optimal shift-map: (i) A "data term" which indicates constraints such as the change in image size, object rearrangement, a possible saliency map, etc. (ii) A "smoothness term", minimizing the new discontinuities in the output image caused by discontinuities in the shift-map. This graph labeling problem can be solved using graph cuts. Since the optimization is global and discrete, it outperforms state of the art methods in most cases.

Efficient hierarchical solutions for graph-cuts are presented, and operations on 1M images can take only a few seconds. Shift-map can also be used for composition of several images.

(b) When we present a video as a 3D space-time volume, we can achieve video summarization by shifting objects in time. Video is summarized because objects that originally appeared at different times will appear together, creating a shorter but more condensed video synopsis. Assuming that the video is captured by a stationary camera as done by security cameras, the summarization process is done in two stages: (i) Moving objects are identified and extracted. (ii) A synopsis video is constructed from the stationary background and the extracted objects, after the objects were shifted in time to occupy a much smaller temporal period. On average one hour of security video is condensed into one minute.

Work with Yael Pritch, Alex Rav-Acha, and Eitam Kav-Venaki

Syllabus: image retargeting; image composition; object removal; video summarization