

Automated Counting of Humans in Images of Dense Crowds

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Abstract:

In this talk, I will present our recent work on visual analysis and counting of extremely dense crowds. Since computer vision algorithms require labeled training data, I will begin by describing the process of collecting crowd images followed by their manual annotation using a GUI-based tool. The first algorithm we developed in 2013 relies on multiple sources of information such as low confidence head detections, repetition of texture elements (using SIFT), and frequency-domain analysis to estimate counts, which is followed by a global consistency constraint on counts using Markov Random Field. Next, I will present our approach using 'deep Learning' which attempts to mimic animal brain through Artificial Neural Networks. The experiments performed on a recent extension of a dataset with one million humans shows the power of this approach over existing machine learning algorithms. For detecting and localizing humans in crowd images, I will discuss how we explore context in the form of locally-consistent scale prior which captures the similarity in scale in local neighborhoods. Using the scale and confidence of detections obtained from an underlying human detector, we infer the scale prior in an iterative mechanism. The detections obtained are then reasoned for occlusion using Binary Integer. Compared to counting approaches which only give a single estimate for entire image, human detection gives locations of humans as well. Finally, I will conclude the talk with the counting results on images from Catalan Separatist Movement demonstrations which took place on Sept 11, 2015 and Sept 11, 2016.