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Opening the black box: Hierarchical sampling optimization for estimating human hand pose

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We address the problem of hand pose estimation, formulated as an inverse problem. Typical approaches optimize an energy function over pose parameters using a 'black box' image generation procedure. This procedure knows little about either the relationships between the parameters or the form of the energy function. In this talk, we show that we can significantly improve upon black box optimization by exploiting high-level knowledge of the parameter structure and using a local surrogate energy function. Our new framework, hierarchical sampling optimization, consists of a sequence of predictors organized into a kinematic hierarchy. Each predictor is conditioned on its ancestors, and generates a set of samples over a subset of the pose parameters. The highly-efficient surrogate energy is used to select among samples. Having evaluated the full hierarchy, the partial pose samples are concatenated to generate a full-pose hypothesis. Several hypotheses are generated using the same procedure, and finally the original full energy function selects the best result. Experimental evaluation on three publically available datasets shows that our method is particularly impressive in low-compute scenarios where it significantly outperforms all other state-of-the-art methods.

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Variational image segmentation model coupled with image restoration achievements

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Image segmentation and image restoration are two important topics in image processing with a number of important applications. In this paper, we propose a new multiphase segmentation model by combining image restoration and image segmentation models. Utilizing aspects of image restoration, the proposed segmentation model can effectively and robustly tackle images with a high level of noise or blurriness, missing pixels or vector values. In particular, one of the most important segmentation models, the piecewise constant Mumford–Shah model, can be extended easily in this way to segment gray and vector-valued images corrupted, for example, by noise, blur or information loss after coupling a new data fidelity term which borrowed from the field of image restoration. It can be solved efficiently using the alternating minimization algorithm, and we prove the convergence of this algorithm with 3 variables under mild conditions. Experiments on many synthetic and real-world images demonstrate that our method gives better segmentation results in terms of quality and quantity in comparison to other state-of-the-art segmentation models, especially for blurry images and those with information loss.

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