INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: A Novel Framework for Segmentation of Skin Regions using Chromatic and Textural Information

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SHORT ABSTRACT

Skin detection is an important step in various image processing and vision-based Human-Computer Interaction (HCI) applications. It is the process of finding skin-coloured pixels and regions in an image or a video. The major challenges of skin detection in images are -- presence of skin-like colours in background and changes in chromatic appearance of skin regions due to non-uniform illumination. In addition to these problems, detection of skin regions in videos is more challenging in presence of time-varying illumination conditions and dynamic backgrounds. Motivated by these facts, we have proposed a set of skin detection algorithms for different environmental conditions using chromatic and textural properties of skin regions. A new probability map termed as discriminative space map (DSM) is proposed by extracting most discriminative features between skin and non-skin regions. A novel adaptive discriminative analysis (ADA) is proposed to extract most discriminant features between skin and non-skin regions from an image itself in an unsupervised manner. Subsequently, a dynamic region growing (DRG) method is employed to allow skin regions to grow dynamically. To handle effect of non-uniform illumination on skin colour, a novel skin detection method is proposed by utilising an image pixel distribution model (IDM), which is derived using a Gaussian Mixture Model (GMM) in a given colour space. In this method, a local skin distribution model (LSDM) and a local background distribution model (LBDM) are derived by exploiting the similarity between the IDM and a reference skin pixel distribution model. The reference skin model is derived from a set of facial skin pixels, and it is termed as facial skin distribution model (FSDM). A local skin probability map (LSPM) can be derived using the LSDM and the LBDM. Finally, a fusion-based skin probability map (FSPM) is obtained by using both the LSPM and an SPM derived from globally obtained skin and non-skin training samples. The chromatic appearance of skin regions may change locally due to local shading effects on account of the motion of body parts. To address this specific issue, a dynamic adaptation scheme is proposed to detect skin regions which are affected by local colour deformations. The proposed method has two modules -- a static module for detection of static skin regions; and a dynamic module for detection of moving skin regions. The static module consists of an FSDM and a video specific background model. The video specific background model termed as fusion-based background distribution model (FBDM) is obtained using an

LBDM and a global background distribution model (GBDM). In the dynamic module of the proposed method, a moving skin distribution model (MSDM) is derived from a set of moving skin samples. Finally, the static and the dynamic modules are fused by following a maximisation rule. Experimental analysis shows that the proposed skin detection method can detect skin region more accurately than the state-of-the-art methods when there exist local chromatic variations of skin appearance.