Multi-scale Fabric Texture Acquisition, Manipulation, Classification and Retrieval (PI: Prof. Baciu George; 2012/13)

Objectives:

We propose to investigate, implement, and analyze new strategies for multi-scale acquisition and retrieval of very large sets of textile fabric swatches. The driving challenge is the integration of multi-scale near-regular texture (MS-NRT) segmentation with SIFT-based short code word feature descriptors in the context of fabric material multi-scale texture classification, ranking and retrieval. The theoretical basis for a successful integration between MS-NRTs and SIFT gives the potential to handle searches in more than a billion multi-scale fabric textures, ranking and retrieval.

We will focus on three physical levels of scale: fabric, yarn, and fiber. The system will consist of:

(a) A new multi-scale acquisition and classification system for fabric materials;

(b) A new texture management system for fabric evaluation and matching; and

(c) A new interactive multi-touch interface for collaborative fabric texture manipulation.

We will focus on the following main research objectives:

(1) MS-NRT: Multi-Scale Near-Regular Texture driven grid system for component selection;

(2) MS-SWIFT: Multi-Scale Short-Word SIFT descriptor generator for component search;

(3) MS-PBM: Multi-Scale Perceptual-Based Metrics for fabric design evaluation and ranking.

The MS-NRTs provide a new reference grid for the identification, classification, and labeling of repeat patterns in fabric textures at multiple scales of

resolution. This also aids in the manipulation, selection and matching of repetitive texture components of fabrics. The MS-SWIFT descriptor generator will establish unique fingerprint-like features within near regular fabric textures and produce short-word codes for fast search and retrieval of large fabric texture databases. The MS-PBM will be tested for a perceptual texture metric for the evaluation of fabric design and classification of fabrics into pattern classes. Integrating (1), (2) and (3) will support matching and retrieval of textile fabrics at three physical scales: fabric, yarn, and fiber. They will provide classification, ranking and matching capability for a large fabric database that we have developed, called iTextile. This database currently contains more than 10,000 samples of real fabric swatches from three large textile manufacturers.

Motivation:

Hundreds of thousands of fabric designs are produced and sourced globally in the garment industry annually. Storage, classification, retrieval and ranking of these fabric designs have become a daunting challenge. Fabric designs have strong cultural, aesthetic and artistic value. Our digital library of fabric designs not only allows the evaluation of the cultural aspects of design, but also evolutionary trends, usage, and cyclical consumer demand. This data can also be further correlated with material sourcing, cost of production, and demographical distribution of design requirements. Our four industry collaborators maintain in excess of three million labeled fabric swatches with various degrees of material quality and design categories. This research is motivated by the need to adopt a fast multi-touch gesture-based interface for collaborative classification of woven and knitted fabrics.

Impact:

The project will contribute to Hong Kong's textile industry, which has been designated as one of the four pillars of Hong Kong's future competitiveness by the

Hong Kong Innovation and Technology Commission. Specifically, we are working with four industrial partners who are actively supporting the development of our digital fabric database, iTextile.*

*Please note that only projects rated 4.5 and above are currently funded by Hong Kong RGC.