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NONNEGATIVE TENSOR FACTORIZATION FOR BRAIN CT IMAGE RETRIEVAL

Weixiang Liu, Kehong Yuan, Jiying Zou

Graduate School at Shenzhen and Department of Biomedical Engineering
Tsinghua University, P. R. China
yuankh@sz.tsinghua.edu.cn

Shoujun Zhou, Wufan Chen

School of Biomedical Engineering
Southern Medical University, P. R. China
chenwf@fimmu.com

Shaowei Jia, Ping Xiao

The Shenzhen Hospital of Peking University, P. R. China
xiaopsz2005@yahoo.com.cn

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Abstract. *Biomedical images provide an essential and inseparable component of diagnosis, treatment and patient follow-ups. It is useful to apply these images to retrieve medically relevant cases from digital patient databases. The main effort in the study concerns image feature reduction using nonnegative tensor factorization (NTF) for neuroimage retrieval. The experimental retrieval results on real brain CT datasets, including two and three classes respectively, show that NTF outperforms both traditional principal component analysis and nonnegative matrix factorization.*
Keywords: Nonnegative matrix factorization, Nonnegative tensor factorization, Principal component analysis, Medical image retrieval

1. **Introduction.** Biomedical images provide an essential and inseparable component of diagnosis, treatment and patient follow-ups. For example, brain computed tomography (CT) image based computer-aided diagnosis (CAD) system is helpful for clinical diagnosis and treatment on normal or tumor cases. Many biomedical / neuroimage retrieval systems depend on content based image retrieval (CBIR) strategy [1, 2]. In a CBIR system, four essential components are: (1) image preprocessing, (2) image feature extraction, (3) image retrieval, and (4) quantitative evaluation, where the key issue (2) is how to represent the image with effective features. Images are always processed and analyzed with visual features, including original gray/color image, color space, texture, shape feature, regions, spatial relation features, even volume of interest, and their combination or fusion [3, 4, 5, 6]. In recent years, semantic based image analysis has been proposed to close the gap between low level visual content and high level semantics of an image [4, 7, 8, 9, 10]. Anyway, the visual content features of an image is the base of other high level features.

In representation of an image, the original and low level visual features always have large size. For example, for a 256×256 gray image, it contains 65536 pixel values. In order to reduce such high dimensionality, many dimension reduction methods have been proposed; e.g. see [11] for more information and references therein. One commonly used method is principal component analysis (PCA) [12]. However the results of PCA contain negativity values, missing physical meanings.