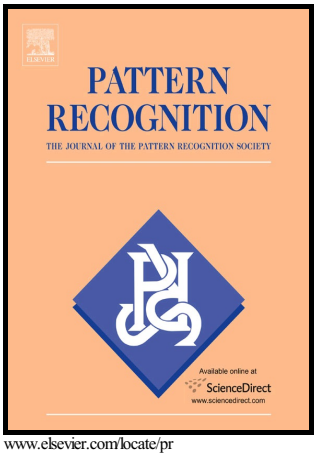

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Multi-modal and Multi-layout Discrimiantive Learning for Placental Maturity Staging

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Abstract— Placental maturity staging is a challenging task due to complex imaging procedure, fetal and gestational age variations. To address this issue, we extract features not only from B-mode gray-scale ultrasound (US) images, but also from color Doppler energy (CDE) images. Based on these features, we propose a method to automatically determine the placental maturity based on multi-view and multi-layout discriminative learning fusion. Specifically, we devise a multi-view technique to generate features of complementary information. Scale invariant features are extracted from image locally, and a Gaussian mixture model (GMM) is then applied to summarize the high-level information features. The clustering representatives from GMM are encoded via a multi-layout Fisher vector (MFV) instead of traditional Fisher vector (FV) to aggregate features based on their spatial information. We apply a multi-layout feature encoding method to improve the staging performance using discriminative learning technique. Extensive experimental results demonstrate that our method achieves promising performance in placental maturity staging and outperform existing methods.

Keywords: Placental maturity staging;Multi-layout Fisher vector; Multi-modal; Fusion; Color Doppler energy imaging

1. Introduction

Over the past decades, ultrasound (US) imaging has been extensively applied in prenatal diagnosis and prognosis due to its benefits such as non-radiation, direct-use, and low-cost [1-8]. The routine placental evaluation is mainly based on US images. The placenta is an important organ for fetal placental blood circulation, gas exchange, nutrient supply, and fetal waste elimination. The placenta