

端到端深度图像分割网络中抑制无效率

学习的目标损失函数设计

叶靖雯, 吴晓峰

(复旦大学 信息科学与工程学院 图像与智能信息处理实验室, 上海 200433)

摘要: 在端到端深度图像分割网络训练时, 常出现前景和背景区域相差巨大的情况, 造成目标特征学习不足而背景特征学习过度. 对此提出一种基于代价敏感学习的目标函数构造方法: 借鉴难例挖掘思想, 使用表征难易程度的 Focal 因子对样本训练误差加权处理, 有效抑制无效率学习; 仿人类视觉系统引入感受野因子, 兼顾上下文信息. 在医学影像数据集上对方法的有效性和可扩展性进行了测试. 结果表明, 新方法有助于提升网络对于小目标的检出能力, 同时分割结果更贴合目标轮廓.

关键词: 深度学习; 医学图像分割; 损失函数设计; 无效率学习

Loss function for ineffective learning reduction in

End-to-End deep image segmentation network

YE Jing-wen, WU Xiao-feng

(Image and Intelligence Lab, School of Information Science and Technology,
Fudan University, Shanghai 200433, China)

Abstract: In image segmentation tasks based on deep learning methods, it is common that foreground pixels occur significantly more frequently than background pixels, and consequently bias the trained network towards them. In this paper, based on cost-sensitive learning, a design method of loss function for end-to-end image segmentation network is proposed, where two improvements are provided as follows: 1) Inspired by the conception of "hard examples mining", focal loss is introduced and extended to work for ineffective learning reduction. 2) Inspired by human visual systems, adaptive weights of receptive field are added to further consider the context information. In order to verify the validity and expansibility, the proposed method has been evaluated on several medical image datasets. The results show that the proposed method can improve the detection performance of the network for small objects, and obtain segmentation results that are more suitable for object contour.

Key words: deep learning; medical image segmentation; loss function; ineffective learning

作者简介:

叶靖雯 女, (1994-), 硕士. 研究方向为医学图像处理.

E-mail: yejw16@fudan.edu.cn.

吴晓峰 男, (1971-), 博士, 高级讲师. 研究方向为图像与信号处理、机器人智能信息处理与控制、多媒体技术应用.