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应用计算机人工智能神经网络系统结合CT与PET鉴别良、恶性肺结节

Computerized distinction of benign and malignant pulmonary nodules on PET and CT with an artificial neural network

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中文摘要:

目的 利用肺结节CT、PET特征, 开发计算机人工智能神经网络(ANN)辅助诊断系统, 评价其对肺结节良恶性的鉴别能力。**方法** 连续收集112例肺内单发小结节(<3.0 cm)患者, 均接受PET/CT及胸部CT检查, 二者间隔小于1个月。112例患者中恶性肺结节52例, 良性60例, 均经组织学或临床随访证实。利用结节的CT特征及PET特征开发计算机ANN辅助诊断系统。计算机ANN的训练及测试采用Round-Robin方法。采用ROC方法评价计算机ANN输出结果并进行统计学分析。**结果** CT计算机ANN程序采用20个输入单元, 包括4个临床特征及16个CT特征, ROC曲线下面积(Az)为0.83; PET计算机ANN程序采用4个临床特征及1个PET特征作为5个输入单元, Az值为0.91; CT+PET计算机ANN程序采用临床特征CT及PET所有21个输入单元, Az值为0.95。与CT计算机ANN程序、PET计算机ANN程序相比, CT+PET计算机ANN程序输出结果明显提高($P=0.015$ 、 0.037)。**结论** CT+PET ANN计算机辅助诊断程序输出结果优于单纯PET或CT计算机ANN结果。当PET对肺结节诊断有困难时, 结节的CT特征有助于鉴别诊断。

英文摘要:

Objective To develop computer-aided diagnostic system using artificial neural network (ANN) method which integrates pulmonary nodule features on CT image with that on PET image for differentiating malignancy from benign pulmonary nodules. **Methods** Totally 112 consecutive patients with pulmonary nodules (<3.0 cm) underwent both thoracic CT and whole-body PET/CT. The interval between CT and PET examinations was less than 1 month. There were 52 malignant and 60 benign lesions confirmed with pathology or clinical follow-up. ANN was used for differentiating benign from malignant nodules based on clinical information together with CT and PET features. Round-Robin method was applied for training and testing the ANN. The output from the computerized schemes were evaluated with receiver operating characteristic (ROC) analysis. **Results** When 20 input units including 4 clinical parameters and 16 CT features were used as input units, the area under ROC (Az) was 0.83. When 4 clinical parameters and 1 PET feature were used as input units, the Az value was 0.91. However, when all of the CT and PET data were used as input units, the Az value was 0.95. The performance of ANN based on both CT and PET data was better than that on CT features alone ($P=0.015$) and PET features alone ($P=0.037$). **Conclusion** Computer-aided diagnostic scheme based on both PET and CT data shows improved performance in differentiating malignant from benign pulmonary nodules compared with that based on PET alone or CT alone. CT is particularly useful when a pulmonary nodule is difficult to be diagnosed by PET alone.

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