Automated chest X-ray screening: Can lung region symmetry help detect pulmonary abnormalities?

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Our primary motivator is the need for screening HIV+ populations in resource-constrained regions for exposure to Tuberculosis (TB), using poster anterior chest radiographs (CXRs). The proposed method is motivated by the observation that radiological examinations routinely conduct bilateral comparisons of the lung field. Also, abnormal CXRs tend to exhibit changes in the lung shape, size and content (textures), and in overall, reflection symmetry between them. We analyze lung region symmetry using multi-scale shape features, and edge plus texture features. Shape features exploit local and global representation of the lung regions, while edge and texture features take internal content, including spatial arrangements of the structures. For classification, we have performed voting-based combination of three different classifiers: Bayesian network (BN), multilayer perception (MLP) neural networks and random forest (RF). We have used three CXR benchmark collections made available by the US National Library of Medicine, and National Institute of Tuberculosis and Respiratory Diseases, India, and have achieved maximum abnormality detection accuracy (ACC) of 91.00% and area under the ROC curve (AUC) of 0.96. The proposed method outperforms the previously reported methods by more than 5% in ACC and 3% in AUC.

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