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Multi-view Multi-scale CNNs for Lung Nodule Type Classification from CT Images

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Highlights

Inspired by the previous works, this paper presents a CNN-based nodule type classification method in a multi-scale multi-view fashion. Different from other classical methods, we also conduct investigation on GGO and non-nodules. The major contributions of our work include:

- A comprehensive method for classifying not only solid nodule types such as well-circumscribed and vascularized ones, but also GGO and non-nodule types.
- A normalized spherical sampling pattern based on icosahedron and a nodule radius approximation method based on thresholding.
- A better view selection method for nodules on CT images based on high frequency content analysis.
- A multi-scale multi-view re-sampling and color projection method for nodules, based on which the CNNs with maximum pooling is trained.
- A comprehensive validation on the publicly accessible datasets of LIDC-IDRI and ELCAP.

At the beginning, we re-build input CT data using a linear interpolation method to make data isotropic. Then, we construct a normalized sphere par- titioned by icosahedra at the center of nodules and sample the volume using concentric circle planes whose normal vectors are from the nodule center to i- cosahedron inner centers. After that, we threshold sampling data and find out the local minimum for intensity distribution as the approximated nodule radius. With this radii, we re-sample the data again in the same ways as that in the second step but at different scales and compute the high frequency content to sort views depending on their importance for each scale. Finally, selected views at all scales are used to first pre-train an independent CNN and then fine-tune it in a multi-view fashion using maximum pooling, resulting in a multi-scale multi-view network.

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