Improving Computer-aided Detection using Convolutional Neural Networks and Random View Aggregation

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***Abstract*—Automated computer-aided detection (CADe) in medical imaging has been an important tool in clinical practice**

[20], [21], [22]. For instance, [19] proposes an MRI-based knee cartilage segmentation using a triplanar ConvNet. [23] describes a supervised 3D boundary detection in volumetric electron microscopf (EM) images via ConvNets.

In this study, we apply ConvNets along with random sets

Fig. 2. Features are computed by convolving filter kernels over the input region of interest. The input image can be padded to produce convolution responses of the same size as the input image.

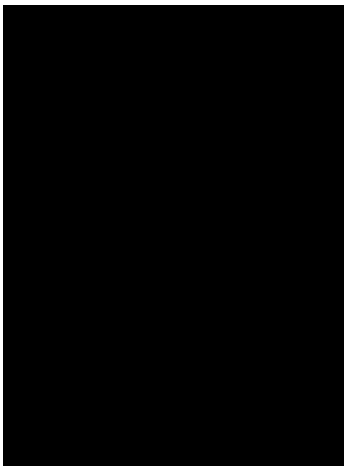

Fig. 3. Some examples of filter responses (Right) after convolution with

4

Random observations

TABLE I

CAD

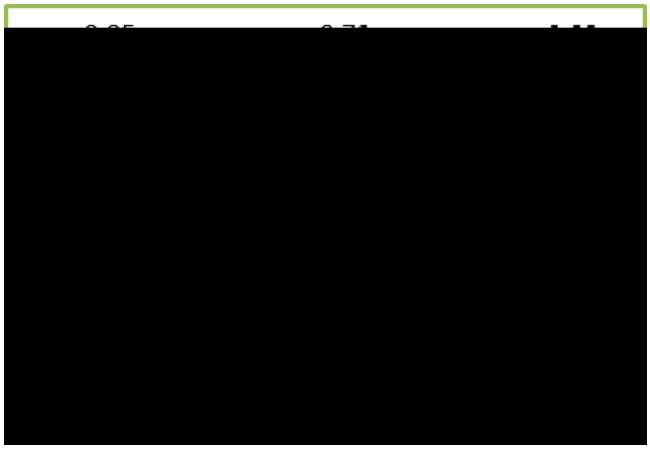

Fig. 11. Detection of lymph nodes: test probabilities of the ConvNet for being a lymph node on ‘true’ (top box) and ‘false’ (bottom box) lymph node candidate examples.

2.5D detection approach, 100% sensitivity at the lymph node

surpasses previous state-of-the-art methods [45], [46], [49]. Furthermore, we use the same set of image features and random forest classifiers in a two-tiered cascade of hierarchy [25]. No improvement in CADe performance is observed.

[18] D. Ciresan, A. Giusti, L. M. Gambardella, and J. Schmidhuber, X223Deep neural networks segment neuronal membranes in electron microscopy images,X22*Advances in neural information processing systems*, pp. 2843X2262851, 2012.

[19] A. Prasoon, K. Petersen, C. Igel, F. Lauze, E. Dam, and M. Nielsen, X223Deep feature learning for knee cartilage segmentation using a triplanar convolutional neural network,X22*MICCAI*, 2013.

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