Lung cancer diagnosis

DeepHealth

Lung cancer is the leading cause of cancer death worldwide, with 1.8 million deaths in 2020 according to the WHO. DeepHealth has developed neural models to support medical staff identify lung nodules from chest CT scans. Leveraging on a large dataset of manually segmented nodules, an AI has been trained to detect anomalies, achieving intersection over union larger than 0.6.

Challenge

Pulmonary nodules are small, focal, radiographic opacities, solitary or multiple. Today, most nodules are detected by computed tomography (CT). Accurate estimation of the malignancy risk of pulmonary nodules, with AI, at chest CT is crucial for optimizing lung cancer screening, which leads to detection of asymptomatic subjects and substantially improves their prognosis.

Solution

Radiology Dept. 2 of Città della Salute e della Scienza has an image tank of 10,000 chest CT scans per year starting from 2014. Among these, 18.485 CT slices were selected with pulmonary nodules and the medical staff re-examined (double-blind) the images. With this relevant amount of annotated data, we developed a Deep Learning solution to detect lung nodules by analysing chest images.

The application is based on a U-Net neural architecture and built on top of the EDDL and ECVL libraries to easily manipulate the images and train the models. The dataset was annotated by expert radiologists by associating each CT scan slice with the diagnosed nodule segmentation map. Then, the U-Net model was trained to recognize and produce the nodule segmentation for each slice and it has been tested using 2316 annotated slices from 173 patients.

In addition, OpenDeepHealth HPC infrastructure has been exploited to train the models to the desired accuracy, enabling fast model computation and parameter tuning. This way, nodules can be segmented automatically with the target level of accuracy.

Benefits

Today clinicians are using our tool in order to compare and evaluate multiple software solutions for lung nodule predictions. Our solution can reach performance useful to enhance visualization from commercial products with the great advantage of being open source and based on internal and trusted expertise and data, that will assure continuous improvements and extension to future clinical needs.

Medical specialty:
Radiology

Use Case:
Lung Cancer

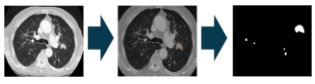
Site:
Turin (Italy)

Entity:

AZIENDA OSPEDALIERO-UNIVERSITARIA
Città della Salute e della Scienza di Torino

DeepHealth Project

DeepHealth is a H2020 collaborative project which develops new HPC and Deep Learning techniques applied to large and complex biomedical datasets to support new and more efficient ways of diagnosis of diseases. The technologies developed (EDDLL, ECVL, etc.) have been validated by clinicians on 14 Use Cases like this, providing 14 Success Stories ready to scale to other healthcare institutions.



From lung slices, to manual nodule segmentation and automatic detection

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https://deephealth-project.eu/

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