Acute ischemic strokes treatment

DeepHealth

Occlusion of a cerebral artery causes the sudden decrease of the blood perfusion in the vascular territory matching the occluded vessel. This potentially leads to death unless properly treated. Fast and accurate analysis of the ischemic non-functioning region, identifying areas with irreversible damage (core) and where recovery is possible (penumbra) might predict the fate of the tissues and drive the treatments.

Challenge

To identify core and penumbra regions, perfusion techniques need to be improved, in particular, CT perfusions (CTP). During CTP, a sequence of low-dose scans is acquired after contrast bolus injection, allowing to compute time-density curves. Standard algorithms allow the generation of many parametric maps to track, for example, blood volume and flow, necessary to identify core and penumbra. These state-of-the-art algorithms are, however, subject to a high-variance outcome, depending on environmental noise, making the estimation of core and penumbra more difficult and inaccurate. Deep Learning represents the state-of-the-art for image generation. However, for the specific use case, there is no data publicly available, and very few studies on deep learning-based approaches have been proposed.

Solution

Within the DeepHealth project, we undertake this challenge with a transversal approach: HPC infrastructure, a curated image database deployed by experts and enriched by validated ground truths (obtained from state-of-the-art approaches) and a tried-and-tested, ready-to-deploy solution. We support physicians with the state-of-the-art OpenDeepHealth HPC cloud infrastructure and a secure tenant for efficient AI computing based on the developed EDDL and ECVL libraries. We also delivered UniToBrain, an open dataset of 258 subjects. We designed and trained UniToBrain deep neural networks for perfusions map generation.

Benefits

We provide a platform fully compliant with the Open Science and FAIR data sharing criteria, implementing robust, innovative techniques that solve the problem of the misfitting of the acquired time series due to unpredictable noise. Obtaining precise maps, even with a poor noise ratio signal, will allow the development of techniques with a lower dose of radiation, clear benefits for the patients and improvement in the diagnosis.

Medical specialty:
Radiology

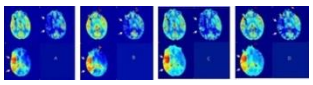
Use Case:
Brain perfusion

Site:
Turin (Italy)

Entity:
UNIVERSITÀ DEGLI STUDI 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.



CT Perfusion Images examples

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https://deephealth-project.eu/

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