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Hepatic artery segmentation with 3D convolutional neural networks

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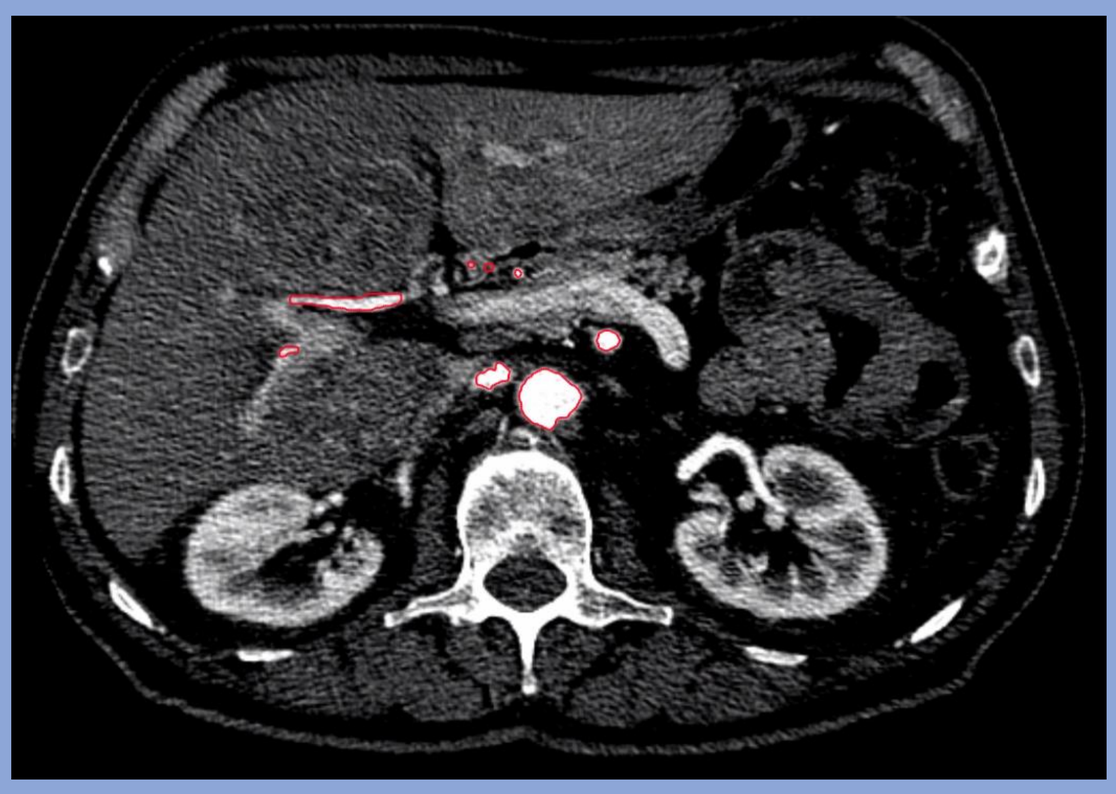
CHALLENGE STATEMENT

According to the data from the GLOBOCON project, liver cancer is the fourth most common cause of cancer-induced deaths in 2018[1]. In order to treat inoperable liver tumors, **selective internal radio therapy** (SIRT) can be applied. It takes advantage of the **dual blood supply** of the liver, in which 25% of the blood is provided by the hepatic arteries, while the remaining 75% are supplied by the portal vein. While healthy liver tissue receives most of its blood supply by the portal vein, liver tumors are mostly supplied by the arteries. Therefore **radioactive beads are injected into the arteries** to be transported towards the tumor tissue [2]. In order to optimize catheter placement, a localization and detailed analysis of the arterial system is essential, especially because anatomical variations are very common, being present in roughly every third individual [3].



Contrast-enhanced computed tomography (CT) with segmentation from radiology assistant (red), which is used as input for the deep learning training.

The following **image processing challenges** have to be considered:

- partial volume effect due to small vessel diameter,
- anatomical variations,
- hepatic veins might also be visible and run parallel to liver arteries.

GOAL

The aim of this research is to develop an automatic artery segmentation algorithm for the arterial phase of contrast-enhanced abdominal computed tomography scans (CTs) with the use of 3D convolutional neural networks.

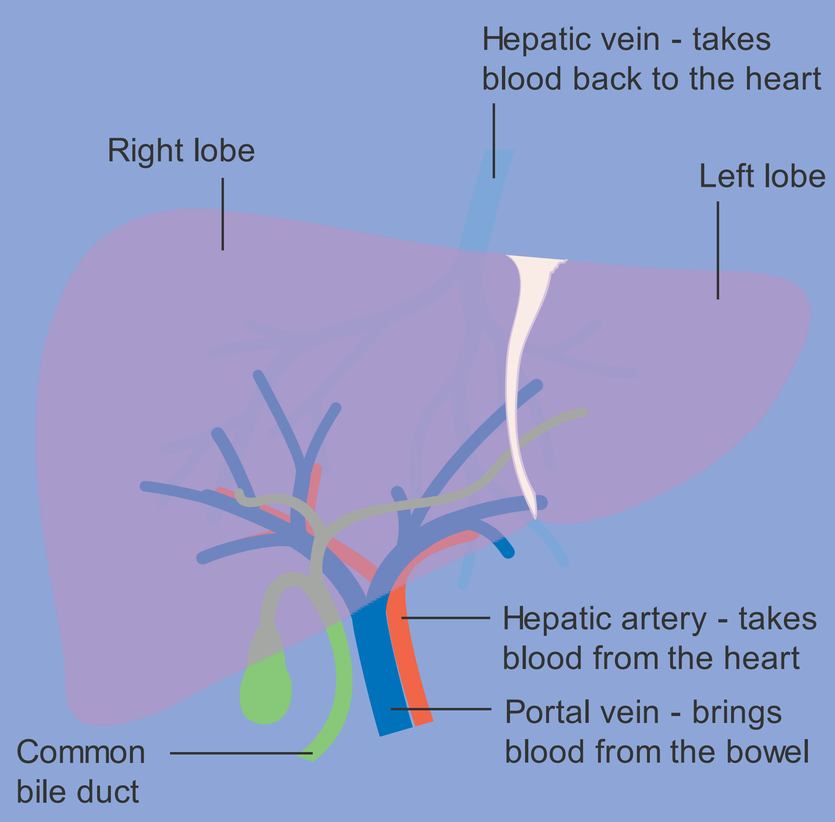


Diagram showing the two lobes of the liver and its blood supply. Cancer Research UK. Creative Commons Attribution-Share Alike 4.0 International License.

[1] Bray F, Ferlay J, Soerjomataram I, et al. **Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries**. CA. 2018;68(6):394-424.
[2] Stubbs R, Wickremesekera S. **Selective internal radiation therapy (SIRT): a new modality for treating patients with colorectal liver met.** Hpb. 2004;6(3):133-139.
[3] López-Andújar R, Moya A, Montalvá E, et al. **Lessons learned from anatomic variants of the hepatic artery in 1,081 transplanted livers**. Liver Transpl. 2007;13(10):1401-1404.