ASMRM & ICMRI 2020
November 03 - 04, 2020 Virtual Congress http://2020.ksmrm.org
ASMRM Korean Society of Magnetic Resonance in Medicine

CSMRM/OCSMRM

SY13-6

Artificial Intelligence in Liver MRI

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Artificial Intelligence（AI）is a hot topic these years. It refers to a broad range of computational methods that mimic human intelligence. Machine learning(ML) is a subfield of AI that relies on statistical methods to detect hidden patterns within a dataset, and deep learning(DL) is a branch of machine learning that harnesses the power of multilayered networks. DL algorithm learns the best features to carry out a given task on its own by navigating the provided, and CNN is the most popular type of deep learning architecture in medical imaging analysis. Many research showed that ML has been applied to various types of data in liver disease research, including staging liver fibrosis, detecting portal hypertension, characterizing focal hepatic lesions, prognosticating malignant hepatic tumors, segmenting liver and liver tumors, et al. Radiomics is a method of research that extracts quantitative radiologic data from medical images and explores the correlation with clinical outcomes. Radiomics features can be divided into morphologic features, histogram features, textural features, and higher-order features. The study of liver diseases by radiomics will contribute to early diagnosis and treatment of liver diseases and improve survival and cure rates of liver diseases. Radiogenomics is a computational discipline that identifies correlations between cross-sectional imaging features and tissue-based molecular data. Imaging phenotypic correlations can then potentially be used to longitudinally and non-invasively predict a tumor's molecular profile.

MRI is routinely performed to evaluate chronic liver diseases such as liver cirrhosis and to detect and characterize focal liver lesions. However, there are some limitations, such as long examination time, motion artifact and multiple breath hold. CNN algorithm can be used for automated screening of T2WI liver acquisitions for nondiagnostic images. Deep learning-based network also can be developed to remove motion artifacts in DCE-MRI images. For tumor characterization, DL can use non-enhanced MRI to distinguish malignant tumors from benign tumors, after adding clinical data, it can provide accurate classification and diagnosis for malignant tumors, which could avoid contrast-related side effects and reduce costs. For liver fibrosis staging, Deep convolutional neural network (DCNN) using hepatic biliary phase images exhibited a high diagnostic performance in the staging of liver fibrosis.

AI provide new insight for imaging assessment of liver diseases. Future research endeavors need to determine how AI can be incorporated into real-world clinical practice.

Keywords: Liver; Artificial Intelligence; MRI