

以人工智慧判讀顳顎關節(TMJ)核磁共振影像

口腔醫學部 | 羅文良主任、邱能泰

摘要

在日常生活中，咀嚼食物能夠協助我們將食物磨碎方便進食。Temporomandibular Joint (TMJ)區域正是協助咀嚼運動的關節區，而TMJ區域退化的患者除了疼痛外，在影像上外型也會產生改變與功能上的衰退。在判斷TMJ區域退化程度中，軟骨(disc)、下顎髁(condyle)、組織液(fluid)是三大指標，了解軟骨與下顎髁的相對位置、組織液的有無，對於疾病的診斷有莫大的幫助。

在診斷上，TMJ MRI 影像能夠清楚呈現軟骨、下顎髁、組織液的位置。本研究使用了約450位患者（包含正常/TMJ受損的患者）的MRI影像，並著重於影像定位與判讀。本研究分為兩大部分，第一部分為影像分割，第二部分為自動判讀。在第一部分影像分割中，我們使用了U-net架構與multimodality的技術進行影像分割，希望能自動將軟骨、下顎髁、組織液從MRI影像中分割出來。第二部份中，我們將使用兩種自動判讀系統，第一種主要架構於SVM分類器，第二種架構於深度神經網路，目標皆為自動判斷（一）軟骨是否有前移（二）下顎髁是否有形變（三）是否有發炎的組織液。最後本研究希望能建立一套人工智慧的TMJ分割與判讀系統，協助醫師診斷。

關鍵詞: 顳頷關節疾病、人工智能、磁共振成像、支持向量機

Abstract

In daily life, chewing food can help us grind food for easy eating. The temporomandibular joint (TMJ) area is the joint that assists chewing. In addition to pain in patients with TMJ degeneration, the appearance of the image will also change and decline in function. In determining the degree of TMJ degeneration, cartilage (disc), mandibular condyle, and joint fluid are three major indicators. Understanding the relative position of cartilage and mandibular condyle, and the presence or absence of joint fluid, are of great help in the diagnosis of TMD.

In diagnosis, TMJ MRI can clearly show the location of cartilage, mandibular condyle, and joint fluid. This study will use MRI of approximately 450 patients (including those with normal and TMJ impairment), with a focus on image localization and interpretation. This study divides into two parts, the first part is image segmentation, and the second part is automatic interpretation. In the first part of the image segmentation, we will use the U-net architecture and multimodality technology for image segmentation, hoping to automatically segment cartilage, mandibular condyles, and joint fluid from MRI images. In the second part, we will use two automatic interpretation systems, the first one is mainly used in the SVM classifier, and the second one is used in deep neural networks. Our goals are automatically judging (i) whether the disc anterior displacement or not; (ii) whether the condyle deforms; (iii) whether there is inflammation of the joint fluid. Finally, this study hopes to establish a TMJ segmentation and interpretation system of artificial intelligence to assist physicians in diagnosis.

keywords: temporomandibular joint disorder, Artificial intelligence, Magnetic resonance imaging, Support vector machines