

ABSTRAK

Nama : Kafah Al Farizi Andeza(140 2021 028);
Anugrah Lan Pambudi(140 2021 006);
Enrio Hernanda(140 2021 021);
Program Studi : Sarjana Teknik Informatika.
Judul : Model AI Untuk *Instance segmentation* Area *Mandibular Condyle*

Temporomandibular Joint Disc Displacement (TMJDD) merupakan gangguan pada sendi *temporomandibular* (TMJ) yang menyebabkan nyeri, keterbatasan gerak, dan suara klik pada rahang. Diagnosis dini sangat penting untuk mencegah komplikasi lanjutan, dengan *Magnetic Resonance Imaging* (MRI) sebagai metode utama dalam visualisasi struktur sendi. Namun, interpretasi citra MRI bersifat subjektif dan membutuhkan waktu serta keahlian khusus, sehingga solusi segmentasi otomatis diperlukan. Penelitian ini mengusulkan pendekatan *Ensemble learning* multi-model menggunakan teknik *Majority voting* untuk meningkatkan *Robustness* sistem segmentasi kondilus mandibula dan mengurangi bias dari model individu. lima model *Deep learning* (*Mask R-CNN*, *Cascade Mask R-CNN*, *HTC*, dan *Mask2Former*, *SoloV2*) dilatih secara terpisah, kemudian hasil segmentasinya digabung menggunakan voting mayoritas piksel, dengan ambang minimal dua model harus setuju. Tahap pasca-pemrosesan berupa *dilasi morfologi* ditambahkan untuk menyempurnakan hasil akhir. Hasil evaluasi menunjukkan bahwa, pendekatan ini berhasil menghilangkan prediksi salah seperti yang terjadi pada model *Hybrid Task Cascade* (HTC), dan menghasilkan segmentasi yang lebih stabil serta bebas noise. Metode ini menunjukkan potensi sebagai solusi segmentasi yang lebih andal dan konsisten untuk aplikasi diagnosis TMJDD berbasis MRI.

Kata kunci: TMJDD, MRI, Segmentasi Kondilus, *Ensemble learning*, *Majority voting*

ABSTRACT

Name : Kafah Al Farizi Andeza(140 2021 028);
Anugrah Lan Pambudi(140 2021 006);
Enrio Hernanda(140 2021 021);
Study Program : Bachelor of Informatics Engineering.
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Temporomandibular Joint Disc Displacement (TMJDD) is a disorder of the temporomandibular joint (TMJ) that causes pain, limited movement, and clicking sounds in the jaw. Early diagnosis is crucial to prevent further complications, with Magnetic Resonance Imaging (MRI) being the primary method for visualizing joint structures. However, MRI image interpretation is subjective and requires significant time and expertise, necessitating an automated segmentation solution. This study proposes a multi-model Ensemble learning approach using Majority voting to enhance the Robustness of mandibular condyle segmentation and reduce bias from individual models. Four Deep learning models (Mask R-CNN, Cascade Mask R-CNN, HTC, and Mask2Former) were Trained separately, and their segmentation results were combined using pixel-wise Majority voting, with a minimum threshold requiring agreement from at least two models. A post-processing step involving morphological dilation was added to refine the final output. Evaluation results show, this approach successfully eliminated false predictions, such as those occurring in the HTC model, and produced more stable, noise-free segmentations. This method demonstrates potential as a more reliable and consistent segmentation solution for MRI-based TMJDD diagnosis.

Keywords: TMJDD, MRI, Condyle Segmentation, Ensemble learning, Majority voting