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הפקולטה למדעי ההנדסה
אוניברסיטת בן-גוריון בנגב
באר-שבע, 84105, ישראל

Department of Mechanical Engineering Seminar
to be held on
Thursday, October 12th, 2023, 11:00

in the Seminar Room (117) of the Mechanical Engineering Building (55)
at the Campus of the Ben-Gurion University of the Negev

Deep-Learning Based Teeth Motion Planning During Orthodontic Treatment

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The seminar is based on Ph.D. thesis supervised by
Prof. Amir Shapiro

Abstract:

Accurate teeth alignment planning is a pivotal step in orthodontic care, typically reliant on computer-assisted software and clear aligners. However, this process suffers from manual segmentation, cumbersome clinical forms, and classical algorithms that falter with complex cases.
The orthodontic treatment journey comprises intricate steps:

1. **Intra-oral Scan** (3D Scan of upper and lower jaw) and Clinical Conditions Form
2. **Teeth Segmentation**: Specialized software semi-automatically isolates individual teeth from scanned STL files using complex algorithms.
3. **Alignment Proposal**: The software suggests a final aligned position for upper and lower teeth, necessitating advanced algorithms accounting for occlusion, aesthetics, and functionality.
4. **Treatment Planning Review**: Orthodontists conduct a meticulous review, lasting about two weeks, to ensure alignment with the patient's specific needs.
5. **Stone Dental Models and clear aligner production**: 3D printing creates precise physical replicas of the dental structure and Clear aligners are meticulously crafted by molding plastic onto stone dental models, ensuring a perfect fit.

Our approach eliminates the requirement for manual intervention, offering high-precision processes such as deep learning-based teeth segmentation, feature extraction, teeth positioning through a Graph Neural Network, and treatment planning using interpolation.
During the seminar, we will focus on one of these stages, specifically the ideal teeth position predicted by a robust model. This model is a fusion of graph and 3D deep learning methods such as Pointnet and Xconv operator from PointCNN model. This critical aspect of our research promises to revolutionize orthodontic treatment planning by leveraging cutting-edge techniques to achieve optimal dental aesthetics, functionality, and occlusal harmony.

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