RESEARCH TOPIC CLI8
Development and validation of AI algorithms to improve the pre-operative assessment of the patient candidate for hip and knee arthroplasty and to define the type and duration of the post-operative course

Research area
Surgical Area

Clinical Unit name
Hip Diseases and Joint Replacement Surgery Unit (ORT1)

Supervisor
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Abstract
Joint replacement is widely used to treat hip and knee disorders. In 2020, more than 40.000 joint replacement operations were performed in Italy. This is expected to increase by 2030 due to the ageing population. Optimising the resources of the National Health System is essential, with better definition Joint replacement is widely used to treat hip and knee disorders. In 2020, more than 40.000 joint replacement operations were performed in Italy. This is expected to increase by 2030 due to the ageing population. Optimising the resources of the National Health System is essential, with better definition of the need for intervention and stratification of patients for early discharge. In the medical field, Artificial Intelligence (AI) emerges as a key resource, enabling early and personalised diagnosis. In orthopaedics, the implementation of AI technology can enable individual patient management regarding the timing for surgery, prevent delays in urgent cases, and identify safety factors for home discharge according to Fast Track. In addition, AI technology can enable follow-up through remote monitoring of objective parameters to intervene where there is a possible criticality. The aim of this innovative PhD project is to provide technology to serve both the patient and the medical professional through the development and validation of AI algorithms based on DL, ML and ANN.

Scientific references
1.Ko S, Pareek A, Ro DH et al. Artificial intelligence in orthopedics: three strategies for deep learning with orthopedic specific imaging. Knee Surg Sports Traumatol Arthrosc. 2022;30(3):758-761. doi:10.1007/s00167-021-06838-8.

2.Martin RK, Ley C, Pareek A, Groll A, Tischer T, Seil R. Artificial intelligence and machine learning: an introduction for orthopaedic surgeons. Knee Surg Sports Traumatol Arthrosc. 2021. doi:10.1007/s00167-021-06741-2.

3.Hui AT, Alvandi LM, Eleswarapu AS, Fornari ED. Artificial Intelligence in Modern Orthopaedics. JBJS Rev. 2022;10(10). doi:10.2106/jbjs.rvw.22.00086.

4.Bini SA. Artificial Intelligence, Machine Learning, Deep Learning, and Cognitive Computing: What Do These Terms Mean and How Will They Impact Health Care? J Arthroplast. 2018;33(8):2358-2361. doi:10.1016/j.arth.2018.02.067.

5.Polisetty TS, Jain S, Pang M et al. Concerns surrounding application of artificial intelligence in hip and knee arthroplasty. Bone Amp Jt J. 2022;104-B(12):1292-1303. doi:10.1302/0301-620x.104b12.bjj-2022-0922.r1.

6.Shaikh HJ, Hasan SS, Woo JJ, Lavoie-Gagne O, Long WJ, Ramkumar PN. Exposure to an Extended Reality and Artificial Intelligence-Based Manifestations: A Primer on the Future of Hip and Knee Arthroplasty. J Arthroplast.2023. doi:10.1016/j.arth.2023.05.015.

7.Myers TG, Ramkumar PN, Ricciardi BF, Urish KL, Kipper J, Ketonis C. Artificial Intelligence and Orthopaedics. J Bone Jt Surg. 2020;102(9):830-840. doi:10.2106/jbjs.19.01128.

Type of contract

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