Leonardo **Tanzi**, PhD Student

Deep Learning and Computer Vision for Health

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Paris, France

Leonardo Tanzi was born on June 4, 1993 and is a Ph.D. Student at the Department of Management and Production Engineering of the Polytechnic University of Turin, Italy. He has more than 7 years of experience in Information Technology.

He received a Master's Degree in Computer Engineering, Graphic and Multimedia Curricula, in 2019, after a six-month thesis research experience at KTH University of Stockholm, Department of Technology and Health.

His current research focuses on human-machine methodologies for smart support during complex interventions, using Deep Learning and Augmented Reality for 3D assistance, with a focus on medical application for computer-assisted surgery during pre-operative and intra-operative procedures. He has collaborated with several research groups in the medical field, such as the CTO of Turin's orthopedic team, the San Luigi Hospital's urology team, and the Molinette's maxillofacial team.

He has published 7 peer-reviewed scientific publications and 1 book chapter in his first two years as a Ph.D. Student.

He has lived in three countries, speaks English, French and Italian. He is currently living in Paris and working as a Ph.D. visiting student at UTC Alliance Sorbonne Université.

Education

Visiting Ph.D., Heudiasyc, CNRS, UTC Alliance Sorbonne Université, Paris 2022 - Present
Research topic: define and implement a hierarchical architecture for femur fracture classification.
Supervisor: Yves Grandvalet.

Philosophiae Doctor (Ph.D.), Dep. of Design, Management and Production, Polytechnic University of Turin, Turin 2019 - Present
Research topic: Deep Learning for human-machine interaction. Supervisor: Enrico Vezzetti.

Master of Science (M.Sc.), Dep. of Computer Science, Polytechnic University of Turin, Italy 2017 - 2019
Final grade: *105/110*. Curriculum in Graphic and Multimedia. Subject: Neural Network for bone fractures classification. Supervisor: Enrico Vezzetti.

Internship, Dep. of Technology and Health, KTH University of Stockholm, Sweden 2019
Research topic: Deep Learning applications for health. Supervisor: Rodrigo Moreno.

Bachelor of Science (B.Sc.), Dep. of Computer Science, University of Parma, Italy 2012 - 2016
Final grade: *104/110*. Curriculum in Computer Science, Telecommunication and Electronic Engineering. Subject: Image corners extraction by the Harris Corner Detector. Supervisor: Riccardo Raheli

Experience

AI Techhnical Writer, MarkTechPost, California, US 2021–Present
Marktechpost is a California-based Artificial Intelligence news platform which focuses on spreading AI Awareness across the globe, reaching more than 200,000 views per month. My role is to summarize scientific papers related to Computer Vision and Deep Learning (see here).

Freelancer, Upwork 2021–Present
Freelancing projects related to Deep Learning for Vision (see here).

Projects

Hierarchical Network, Heudiasyc, CNRS, UTC Alliance Sorbonne Université, Paris 2022–Present
Implementation of a neural network suitable for hierarchical vision problem in the medical domain, based on a hierarchical loss and a factor of regularization which take in consideration the specific structure of the data.

Computer Assisted Prostatectomy, San Luigi Hospital, Turin 2020–Present
Implementation of a Deep Learning based application to segment the endoscopic video stream during real-time prostatectomy. In the fifth phase of this procedure, the biopsy, it is crucial to locale the area where the tumor was before the removal of the prostate. Using the catheter as an anchor, the 3D model is attached to the 2D stream of the Da Vinci robot to help the surgeon locate the correct area. This work is being carried out and tested during in-vivo surgery in collaboration with the Urology unity of the San Luigi Hospital, in Orbassano (To) – Italy.

Bone Fractures Classification, CTO Turin and KTH Stockholm 2019–Present
Implementation of a software to recognize and classify bones fractures with a Vision Transformer. Following the classification outlined by the AO Foundation, we developed a method able to discern among different types of fractures and sub-fractures of the proximal femur. This work is carried out and tested in collaboration with the Turin's CTO (Traumatology Orthopedic Center) and the KTH University of Stockholm.

Computer Assisted Maxillofacial Surgery, Molinette Hospital, Turin 2021–Present
Implementation of a Deep Learning based application to assist specialist in surgery pre-planning. As a first step, we are implementing an algorithm that could classify a person into three classes: Mandibular Prognathism, Mandibular Progenism, and Mandibular Laterodeviation. This work is being carried out in collaboration with the Maxillofacial unity of the Molinette Hospital, in Turin – Italy.

Surgical Video Stream Predictor, Polytechnic University, Turin 2021–Present
Implementation of a Vision Transformer for temporal data to detect negative events during a generic surgical operation. This work is carried out with the Urology unity of the San Luigi Hospital, in Orbassano (To) – Italy.

Face Emotion Classifier, Polytechnic University, Turin 2021–Present
Implementation of a 3D neural network to classify different types of emotions in human face, based on 3D convolution which cooperate with a Transformer-based 2D architecture for the classification. This work is carried out in collaboration with the Polytechnic University of Milan.

Assisted 3D Printing, Polytechnic University, Turin 2020–2021
Implementation of an Augmented Reality and Deep Learning based application to assist the user during faults in the process of 3D printing and save time and material. Deep Learning will be used for object detection and to locate malfunctions, and Augmented Reality to help the user's intervention.

Certifications

Scientific Computing with Python by freeCodeCamp 2022

Convolutional Neural Networks by deeplearning.ai 2021

Structuring Machine Learning Projects by deeplearning.ai 2021

Improving Deep Neural Networks by deeplearning.ai 2021

Neural Networks and Deep Learning by deeplearning.ai 2020

Machine Learning, Data Science and Deep Learning with Python by Udemy 2019

Teaching

Teaching assistant, 3D graphics solutions in biometric applications 2022
Master course ING-INF/05, Polytechnic University of Turin

Teaching assistant, Modelling Design 2021
Bachelor course ING-IND/15, Polytechnic University of Turin

Teaching assistant, Engineering Drawing 2020
Master course ING-IND/15, Polytechnic University of Turin

Guest Lectures

Lecturer, IEEE Fiji for the University of South Pacific 2021
Application of Transformers in Vision

Languages

Italian: Native proficiency

English: Professional proficiency

French: Basic proficiency

Publications

Peer-reviewed journals

[1] Vision Transformers for femur fracture classification
Leonardo Tanzi, Andrea Audisio, Giansalvo Cirrincione, Alessandro Aprato, Enrico Vezzetti
Injury (2022)
DOI: https://doi.org/10.1016/j.injury.2022.04.013

[2] Real-time deep learning semantic segmentation during intra-operative surgery for 3D augmented reality assistance
Tanzi L, Piazzolla P, Vezzetti E, Porpiglia F
International Journal of Computer Assisted Radiology and Surgery (2021), Springer
DOI: 10.1007/s11548-021-02432-y

[3] Hierarchical Fracture Classification of Proximal Femur X-Ray Images Using a Multistage Deep Learning Approach
Tanzi L, Vezzetti E, Moreno R, Aprato A, Audisio A, Massè A
European Journal of Radiology 133 (2020), Elsevier
DOI: https://doi.org/10.1016/j.ejrad.2020.109373

[4] Intraoperative Surgery Room Management: a Deep Learning Perspectives
Tanzi L, Piazzolla P, Vezzetti E
The International Journal of Medical Robotics and Computer Assisted Surgery (2020)
DOI: https://doi.org/10.1002/rcs.2136

[5] A deep learning framework for real-time 3D model registration in robot-assisted laparoscopic surgery
Padovan E, Marullo G, Tanzi L, Piazzolla P, Moos S, Porpiglia F, Vezzetti E
The International Journal of Medical Robotics and Computer Assisted Surgery (2022)
DOI: https://doi.org/10.1002/rcs.2387

[6] X-Ray Bone Fracture Classification Using Deep Learning: a Baseline For Designing a Reliable Approach
Tanzi L, Vezzetti E, Moreno R, Moos S
Applied Sciences (2020), Multidisciplinary Digital Publishing Institute
DOI: https://doi.org/10.3390/app10041507

[7] Dynamic evaluation of THA components by Prosthesis Impingement Software (PIS)
Giachino M, Aprato A, Revetria TA, Vezzetti E, Massè A, Ulrich L, Tanzi L
Acta Biomedica Parmensis (2021)
DOI: 10.23750/abm.v92i5.998

Books' chapter

[1] Computer-Aided Diagnosis System for Bone Fracture Detection and Classification: a Review on Deep Learning Techniques
Tanzi L, Vezzetti E, Aprato A, Audisio A, Massè A.
An Introduction to Approaches and Modern Applications with Ensemble Learning, 2020

Patent

System and method for processing endoscopic images 2021
Deposit ID: 102021000017525

Conferences

Swedish Society for Biomechanics Annual Meeting, Stockholm 2021
Hierarchical Fracture Classification of Proximal Femur X-Ray Images Using a Multistage Deep Learning Approach