Mattia Perrone

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Summary

Research Scientist specialized in deep learning applied to 2D and 3D medical imaging with a publication track record in computer vision and generative deep learning. My areas of expertise also include NLP, deep learning applied to time series and signal processing. Check out my homepage for my project portfolio

Experience

Research Scientist Sep 2023 - Present

Rush University Medical Center — NLP, Computer Vision, PyTorch, Python, Matlab *Chicago, Illinois*

- Designed an end-to-end lumbar-spine MRI pipeline to generate radiology reports by **fine-tuning vision-language models** (**Rouge-L ↑ 20%** and **BERTScore ↑ 3%** vs **GPT-4 Turbo** zero-shot baseline)
- Implemented a **3D CNN-Autoencoder** for feature learning in segmented lumbar spine MRI, leveraging these latent features to enhance prediction of disc pathologies **(F1-score ↑ 3%; AUC-ROC ↑ 3%)** - Conference - Publication - GitHub
- Leveraged **TotalSegmentator** for **spine segmentation** on CT scans and performed PET-to-CT registration to analyze metabolic activity in lumbar vertebrae of patients with scoliosis. Spinal regions subjected to higher mechanical load exhibited lower disc metabolic activity **(p=0.03)** - Conference - GitHub
- Designed a **Transformer-CNN** based architecture to predict knee implant wear, reducing processing time from days (FEA approach) to minutes (ML approach). **MAPE values < 3%** for wear scar length and **< 6%** for wear scar width were obtained between predictions and ground truths - Conference - Publication - GitHub
- Reviewed manuscripts in the field of **machine learning** for research journals (e.g. J. Supercomput., Scientific Reports, JOR spine, J Biomech, European Spine Journal) and international ML conferences (e.g. MICCAI)

Research Assistant - Machine Learning Jan 2022 - Aug 2023

Arcadia University — Time series analysis, Tensorflow, Keras, Matlab, Python *Glenside, Pennsylvania*

- Developed computational models of 10 healthy subjects and 10 patients with FAI quantifying differences in terms of hip joint forces between the two groups (5% of the maximum value) - Publication - Conference - Webcast
- Implemented an **LSTM model** that aims at estimating hip joint moments, replicating the same task of the computational models developed (nRMSE: 9.62%, r: 0.94: nMAE: 15.55%) - Publication - Conference
- Designed a **variational autoencoder (VAE)** and a **generative adversarial network (GAN)** to create synthetic time series data of controls and patients. When trained both on real and synthetic data, the LSTM model showed better performances in terms of nRMSE (5% lower on average) - Publication - Conference

Education

University of Illinois at Chicago Mar 2021 - Dec 2022

Master of Science: Biomedical Engineering (Dual Degree) - GPA: 4.0/4.0 *Chicago, Illinois*

Politecnico di Milano Sep 2020 - Dec 2022

Master of Science: Biomedical Engineering (Dual Degree) - GPA: 110/110 cum laude *Milan, Italy*

Politecnico di Milano Sep 2017 - Jul 2020

Bachelor of Science: Biomedical Engineering - GPA: 110/110 cum laude *Milan, Italy*

Selected Publications

A CNN Autoencoder for Learning Latent Disc Geometry from Segmented Lumbar Spine MRI
Perrone M., Moore D., Ukeba D., Martin J. *Annals of Biomedical Engineering - Sep 2025*

Gait-to-Contact (G2C): A Novel Deep Learning Framework to Predict Total Knee Replacement Wear from Gait Patterns
Perrone M., Simmons S., Malloy P., Karas V., Yuh C., Martin J., Mell S. *Annals of Biomedical Engineering - Sep 2025*

Synthetic Data Generation in Motion Analysis: A Generative Deep Learning Framework
Perrone M., Mell S., Martin J., Nho S., Simmons S., Malloy P. *Journal of Engineering in Medicine - Jan 2025*

Machine Learning-Based Prediction of Hip Joint Moment in Healthy Subjects, Patients and Post-Operative Subjects
Perrone M., Mell S., Martin J., Nho S., Malloy P. *Computer Methods in Biomechanics and Biomedical Engineering - Jan 2024*

Hip Joint Contact Forces are Lower in Patients with Femoroacetabular Impingement Syndrome During Squat Tasks
Perrone M., Guidetti M., Galli M., Nho S., Wimmer M., Malloy P. *Journal of Orthopaedic Research - Nov 2023*

Technical Skills

Programming Languages: Python, MATLAB, C, R
ML Libraries: PyTorch, TensorFlow, Keras, scikit-learn, pandas, NumPy, OpenCV, scikit-image, ONNX
Medical Imaging Frameworks: pydicom, NiBabel, pynrrd, SimpleITK, MONAI, 3D Slicer, ImageJ