Mattia Perrone

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SUMMARY

Research Scientist with 3+ years of experience developing machine learning models on real-world clinical data. Expertise in deep learning applied to medical imaging with a publication track record in computer vision and generative deep learning. See my personal website for details.

EXPERIENCE

Research Scientist Sep 2023 - Present
Rush University Medical Center — Computer Vision, NLP, 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) Conference
- Implemented a **3D CNN-Autoencoder** for feature learning in segmented lumbar spine MRI, leveraging latent features to enhance prediction of disc pathologies (**F1-score ↑ 3%; AUC-ROC ↑ 3%**) Publication - GitHub - Conference
- 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 ($p < 0.05$) GitHub - Conference
- 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 Publication - GitHub - Conference
- Developed a hybrid **NLP pipeline** (regex + GPT-4) for **clinical text mining** from **radiology reports** and implemented a linear mixed effect model that revealed a correlation between race and low back pain Conference
- 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 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) Webcast - Publication - Conference
- 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