DI MARTINO Thomas

PhD student in SAR time series of vegetation & Deep Learning

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EDUCATION

2020 - 2023 • **PhD in Remote Sensing** • SONDRA, Université Paris-Saclay, CentraleSupélec, ONERA, France
Thesis focusing on problematics of change detection in SAR Time Series of forests with the help of Deep Learning methods under the supervision of Régis Guinvarc'h, Laetitia Thirion-Lefevre & Elise Koeniguer.

2019 - 2020 • **MSc in Artificial intelligence with Speech & Multimodal Interaction (Distinction)** • Heriot-Watt University, Edinburgh, Scotland
Studied topics such as Biologically Inspired Computation, Industrial Programming, Big Data Management, Data Visualisation, Machine Learning MSc Thesis: Multimodal Similarity Learning for Duplicate Product Identification

2015 - 2020 • **MEng Degree in Computer Science** • Ecole Internationale des Sciences du traitement de l'information, Cergy, France
Studied concepts such as Programming, Database Management, Software Engineering, Probabilities & Statistics, Machine Learning, Optimization

WORK EXPERIENCE

Doctoral student @ SONDRA Lab, CentraleSupélec, ONERA, France (October 2020 – October 2023)
Research activities split between two laboratories: SONDRA at CentraleSupélec, Gif-sur-Yvette, and IVA at ONERA, Palaiseau.

Visiting Researcher @ ESA-ESRIN, Phi Lab, Frascati, Italy (October 2022 – December 2022)
Research activities focusing on advancing the usage of Convolutional Autoencoders for unsupervised anomaly detection in SAR time series of vegetated environments.

Deep Learning Researcher Intern @ E.Fundamentals, Edinburgh, Scotland (May – September 2020)
Use of multimodal deep learning algorithms for duplicate product identification in a multi-retailer database.

Deep Learning Researcher Intern @ Thales AVS, Osny, France (April – September 2019)
Training of a Deep learning Mask R-CNN network to detect and segment buildings in optical satellite imagery.

Software Engineering Intern @ ATOS Worldline, Bezons (95) (June – September 2018)
Provided Worldline's client with a three-tiers application for an e-money back-end.

JOURNAL PUBLICATIONS

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre and É. Colin, "**Grad-SLAM: Explaining Convolutional Autoencoders' Latent Space of Satellite Image Time Series,**" in *IEEE Geoscience and Remote Sensing Letters*, doi: 10.1109/LGRS.2023.3302906.

T. Di Martino, B. Le Saux, R. Guinvarc'h, L. Thirion-Lefevre and É. Colin "**Detection of Forest Fires through Deep Unsupervised Learning Modeling of Sentinel-1 Time Series**," in *ISPRS International Journal of Geo-Information*. 2023; 12(8):332. doi: 10.3390/ijgi12080332

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre, and E. Colin, "**FARMSAR: Fixing AgRicultural Mislabels using Sentinel-1 time series and AutoencodeRs**," *Remote Sensing,* vol. 15, no. 1, doi: 10.3390/rs15010035

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre, and E. Colin, "**Beets or Cotton? Blind Extraction of Fine Agricultural Classes Using a Convolutional Autoencoder Applied to Temporal SAR Signatures,**" *IEEE Transactions on Geoscience and Remote Sensing*, vol. 60, pp. 1-18, 2022, Art no. 5212018, doi: 10.1109/TGRS.2021.3100637.

CONFERENCE PUBLICATIONS

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre, and E. Colin, "**Retrieval of boreal forest physiology parameters from C-Band SAR time series using Deep Learning,**" *2023 IEEE International Geoscience and Remote Sensing Symposium IGARSS (accepted)*

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre, and E. Colin, "**Modelling of agricultural SAR Time Series using Convolutional Autoencoder for the extraction of harvesting practices of rice fields,**" *EUSAR 2022; 14th European Conference on Synthetic Aperture Radar*, 2022, pp. 1-6.

L. Charrier, T. Di Martino, E. Colin, F. Weissgerber, and A. Plyer, "**Extracting Relevance from SAR Temporal Profiles on a Glacier and an Alpine Watershed by a Deep Autoencoder,**" *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLIII-B3-2022, 1309–1316, https://doi.org/10.5194/isprs-archives-XLIII-B3-2022-1309-2022, 2022.

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre, and E. Colin, "**Convolutional Autoencoder for Unsupervised Representation Learning of PolSAR Time-Series,**" *2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS,* 2021, pp. 3506-3509, doi: 10.1109/IGARSS47720.2021.9555138.

T. Di Martino, M. Lenormand, and E. Colin, "**Multi-Branch Deep Learning Model for Detection of Settlements Without Electricity,**" *2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS*, 2021, pp. 1847-1850, doi: 10.1109/IGARSS47720.2021.9554286.

HONORS / AWARDS

3rd Place winner of the Data Fusion Contest 2021 (IEEE GRSS IADF)
The challenge in question, involving the detection of settlements without electricity, aims to leverage multimodal and multi-temporal remote sensing data, combining SAR & Optical data, for the greater good. For that task, my team (Myself, Maxime Lenormand & Elise Colin) developed a custom Multi-Channel Deep Learning architecture that we presented during an invited session at IGARSS 2021.

Winner of 2 categories (Early Bird, Main Track) of the Sentinel Hub custom script competition 2020
Collaborative work realized by me, Elise Colin, Regis Guinvarc'h, and Laetitia Thirion-Lefevre with the implementation of REACTIV, a multi-temporal method for change visualization in SAR Time Series.

OTHER SCIENTIFIC ACTIVITIES

Field campaigns:

- Collaboration with DLR researchers to acquire TerraSAR-X and TanDEM-X imagery over the Toulouse area. Installation of trihedral structures under multiple level of vegetation cover for target detection assessment.
- Canadian boreal forest field expedition with the goal of understanding the underlying structure of forested areas, cut areas, and old burn scars.

Research exchange as a visiting researcher at the European Space Agency:
Invited by the Phi-LAB to spend 2 months in ESA-ESRIN's lab, in Frascati, Italy, to pursue parts of my doctoral study, regarding the applicability of Convolutional Autoencoders to the extraction of anomalies from a vegetated environments using SAR Time Series.

IEEE Reviewer
Reviewed 2 submissions for IEEE TGRS journal, and one submission for IEEE GRSL journal

CORE SKILLS

Programming: Python, Java, C++
Machine Learning Concepts: Supervised, unsupervised, semi and self-supervised learning; Neural Networks, Tree-based models, Clustering, Image Processing, Computer Vision
Machine Learning / Programming Tools : Pytorch, Scikit-learn, NumPy, Matplotlib, Jupyter
Remote Sensing Concepts : SAR Imagery, SAR Processing, Multitemporal SAR, Polarimetric SAR, Interferometric SAR, Multispectral Imagery, Optical Imagery
Remote Sensing Tools : Google Earth Engine, SNAP, EO Browser, QGIS, GDAL, ASF, Copernicus Sci-Hub

SIDE ACTIVITIES

Medium Articles writer (@dimartinot)
Writing medium articles on various scientific topics, including Earth Observation and Artificial Intelligence.
GEESARFETCHER Maintainer
Maintaining a Python library to download SAR GRD multi-temporal imagery from Google Earth Engine.

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