DI MARTINO Thomas

PhD student in SAR & Deep Learning, at SONDRA, CentraleSupélec/ONERA, France

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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 & Analytics, Machine Learning
MSc Thesis: Multimodal Similarity Learning for Duplicate Product Identification

2015 - 2020 • **Engineering 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 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 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 E. Colin, "**Explainability of Convolutional Autoencoders latent space using gradient-based analysis applied to satellite image time series**," *(in progress)*

T. Di Martino, R. Guinvarc'h, L. Thirion-Lefevre and E. Colin, "**FARMSAR: Fixing AgRicultural Mislabels using Sentinel-1 time series and AutoencodeRs**," *(under review)*

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 , "**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. (*to be published*)

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.

CONFERENCES & TALKS

EUSAR 2022:

- "Modelling of agricultural SAR Time Series using Convolutional Autoencoder for the extraction of harvesting practices of rice fields," *Oral Presentation*

CSRS 2022:

- "Relating Sentinel-1 time-series to boreal forest attributes using Convolutional Autoencoders," *Oral Presentation*

LPS 2022:

- "Extraction of variations in agricultural practices over rice fields using unsupervised learning," *Poster*
- "Convolutional Autoencoder for the unsupervised extraction of fire footprints from Sentinel-1 time-series," *Poster*

IGARSS 2021:

- "Convolutional Autoencoder for Unsupervised Representation Learning of PolSAR Time-Series," *Multimedia Presentation*
- "Multi-Branch Deep Learning Model for Detection of Settlements Without Electricity," *Oral Presentation*

TEACHING EXPERIENCE

Teaching Assistant, CentraleSupélec, Gif-sur-Yvette (2021 –2022)

- Co-supervised an intern on the topics of agricultural modelling using SAR and optical satellite imagery. Supervision involved the monitoring of their progress, and guidance for the directions of their work. Their internship lasted approx. 5 months
- Co-supervised practical sessions of SAR Image processing, using SNAP software for various tasks, including polarimetric imaging analysis and change detection + co-monitored the students during a week-long project, applying their EO knowledge to forest preservation applications (~ about 10+27h total)
- Co-managed a group of students working on improving road segmentation results extracted from SAR Imagery using Machine Learning techniques, for a semester-long project (~ about 10h total)
- Co-supervised of a group of 4 students for a research project on evaluating the burnt condition of Canadian forests using SAR, for a semester-long project (~ about 20h total)

Teaching Assistant, CentraleSupélec, Gif-sur-Yvette (2020 –2021)

- Monitored and advised two groups of 4 students researching the potential of SAR multi-temporal imagery for Canadian Forest monitoring during a week-long project (~ about 27h total)
- Co-managed two groups of students working on road segmentation from optical and/or SAR imagery using Machine Learning techniques during a year-long project (~ about 10h total)

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.

The Data Lab MSc Scholarship
Merit-based scholarship to pay for my tuition fees for my 2019-2020 year of study at Heriot-Watt University.

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:** 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++, SQL **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. **Earth Observation Instagram Account Maintainer (@earth_in_a_nutshell)** Maintaining an Instagram account of Earth Observation posts, posting visuals of natural events (fire, eruptions, etc.).

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