Internship position: Master 2 in artificial intelligence/Machine learning/Data analysis

Title: "Prediction of weeds growth"

Profile: Academic level equivalent to a Master 2 in progress or Engineer in its 5th year, in computer science
Duration: 4 to 6 months, from February 2023
Affiliation: Computer Science Lab of the Université de Tours (LIFAT), Pattern Recognition and Image Analysis Team (RFAI)
Indemnity: according to French legislation (around 600€/month in average); plus indemnity for local transports
Supervisor: Nicolas RAGOT (LIFAT-Tours)
Skills:
- a good experience in data analysis and machine learning (in python) is required
- some knowledge and experiences in deep learning and associated tools will be highly considered
- curiosity and ability to communicate and share your progress and to make written reports
- ability to propose solutions
- autonomy and good organization skills

How to candidate:
Send the following documents by e-mail to **nicolas.ragot@univ-tours.fr** before 1st of February 2023: a CV, motivation letter, your scores including bachelor degree, and references from teachers or people you worked with

Context:
This internship takes place inside the regional project DESHERB'ROB (https://desherbrob.insa-cvl.fr) which aims at elaborating new robots for high precision E-agriculture. The robot should be able to localize precisely weeds and to remove them. The originality of the project relies on the use of data coming from drone images as well as temporal data to predict the growth of the weeds and to try to combine them to detect at the earliest the location of weeds apparition. The internship will be done in close relationship with a PhD student.

Goals:
The main goal of this internship is to work on a neural network model taking as inputs local climatic data (temperature, humidity, light…), previous observations about weeds growth during the year, previous observations about geo-localization of weeds in the fields. The geo-localized predictions will be combined with recognition based on image analysis of drone (work of the PhD).

Methodology:
1 A state of the art will be made about neural networks methods for multivariate time series. A focus on transformers and attention mechanism will be done. At the same time, a literature review on grass growth prediction will be conducted, using [Guyet et al. 2022] as a starting point.

2 Data collection, cleaning and preparation will be done, based on known benchmarks as well as true data. Defining experimental protocol.
3 Based on 1, an architecture will be proposed and implemented. As a first step, the geo-localization will not be considered.
4 Learning of the model.
5 Evaluation of the prediction based on several criteria (detection, growth…)
6 Improvements and addition of geo-localization.
7 Documentation, reports and cleaning of the code to make it reusable (using Git)

Bibliography:

- T. Guyet, L. Spillemaecker, S Malinowski, and A.-I. Graux. *Temporal Disaggregation of the Cumulative Grass Growth.* ICPRAI 2022, LNCS 13364, pp. 383–394, 2022. https://doi.org/10.1007/978-3-031-09282-4_32
- S. Li, X. Jin, Y. Xuan, X. Zhou, W. Chen, Y.-X. Wang, and X. Yan. *Enhancing the locality and breaking the memory bottleneck of transformer on time series forecasting*. In Advances in Neural Information Processing Systems, pp. 5243–5253, 2019
- G. Zerveas, S. Jayaraman, D. Patel, A. Bhamidipaty, C. Eickhoff. *A Transformer-based Framework for Multivariate Time Series Representation Learning*. arXiv:2010.02803
- J. Ma, Zheng Shou, Alireza Zareian, Hassan Mansour, *A. Vetro, and S. Chang. Cdsa: Cross-dimensional self-attention for multivariate, geo-tagged time series imputation*. ArXiv, abs/1905.09904, 2019