Tree quality assessment using close-range remote sensing data

Supervisors

dr hab. inż. Tomasz Trzciński, prof. PW (IDEAS NCBR)
dr hab. inż. Paweł Morawiecki, prof. IPI PAN

Description

This doctoral research project aims to utilize artificial intelligence (AI) to accurately discern the size, quality, and health of trees for optimized forest management. Trees hold significant economic value, largely determined by factors such as their size and the presence or absence of defects on the trunk's lateral aspects. The facets of the trunks may also harbor a myriad of parasitic entities or bear the impacts of different biotic and abiotic factors, each providing insights into the tree's present and future health status.

Trees are integral components of both forest and urban ecosystems, playing vital roles in biodiversity, climate regulation, and community well-being. However, assessing the health and quality of trees manually across these environments is time-consuming, labor-intensive, and prone to human error. As such, there is an urgent need for an automated, efficient, and accurate system for tree inventorying and health assessment.

Our project proposes to fill this gap by developing an AI-driven system to facilitate forest protection and urban greenery management. By utilizing close-range remote sensing technology, we aim to capture high-resolution data capable of visualizing various artifacts present on trees.

Artificial Intelligence, with its advanced pattern recognition and machine learning capabilities, will be applied to analyze this remote sensing data. This approach can significantly enhance the probability of detecting tree artifacts, which are indicative of tree health and quality. Such an AI-driven system will allow us to take inventory of trees and assess their health status automatically and efficiently, with a high level of accuracy [1, 2].

The AI algorithms we develop will be designed to recognize the size and quality of trees, hence providing valuable information for forest management. This automatic inventorying process will greatly facilitate the management and protection of forests and urban green environments.

Given the broad nature of this project, the PhD candidate will have the opportunity to work with several different remote sensing technologies, in a variety of environmental settings including forests and urban locales. The versatility of the project allows for potential tailoring of the work according to the candidate's specific expertise and commitment level. An expertise and advice in precision forestry will be provided by prof. Krzysztof Stereńczak (IDEAS/NCBR).

Through this project, we hope to contribute significantly to the field of forest management and urban greenery conservation, by incorporating technology and artificial intelligence in a novel and impactful way.

Requirements

- MSc degree in computer science or related field,
- Good knowledge of computer vision and machine learning, including practical experience with programming in Python and relevant libraries (PyTorch, TensorFlow, Keras)
- Advanced skills in written and spoken English
- Publication track record in major CS/ML/CV venues (e.g. CVPR, ICML, NeurIPS) **is a plus**

References

[1] Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi. You only look once: Unified, real-time object detection. In *2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 779–788, 2016.

[2] Przemyslaw Spurek, Sebastian Winczowski, Jacek Tabor, Maciej Zamorski, Maciej Zieba, and Tomasz Trzcinski. Hypernetwork approach to generating point clouds. In *Proceedings of the 37th International Conference on Machine Learning, ICML 2020, 13-18 July 2020, Virtual Event*, volume 119 of *Proceedings of Machine Learning Research*, pages 9099–9108. PMLR, 2020.