**Press Release**

**State-of-the-art method helps to identify tree species and deadwood**

*A research group at the Munich UAS introduces an efficient method to assist the administration of Bavarian Forest National Park in their forest inventory program.*

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SÜDDEUTSCHE ZEITUNG | WISSEN - The Computer Vision, Remote Sensing, and Navigation (CORSNAV) Research Group under supervision of the lecturer and researcher in remote sensing at the Munich UAS, Prof. Dr. Peter Krzystek collaborated with the Digital Transformation Lab to develop a faster means for detecting single trees in a forest region. The method uses artificial intelligence (AI) which were trained on virtual computer with tree samples collected from the national park. The administration can then delegate the task of analyzing forest composition to AI, as to spare time and expense needed to deploy survey teams. Scientists who are looking to research on other forest regions can potentially benefit from this method.

Advanced remote sensing technique such as airborne laser scanning (ALS) is widely adopted in forest mapping as an alternative to conventional land surveying. By using a high precision laser scanner attached to a airborne platform (helicopter, drones, etc.), wider area can be covered in shorter period of time. Another advantage of ALS is the accurate 3D visualization of the forest structure composed from millions of georeferenced point clouds. From this visual data, more information like tree species and deadwood can be further derived for the forest inventory automatically through the use of AI. Machines can make predictions which trees belong to which category if they are ‘trained’ optimally before, with enough reference samples. This process is called ‘machine learning’. There are several known learning algorithms such as ‘random forest’ or ‘logistic regression’, which were experimented by the CORSNAV Research Group to classify a single tree into their respective species as well as to detect deadwood. The classification accuracy of these algorithms, however, still left room for improvement (around 70-80%). The reason for this were the small amount of reference samples from all category and because of the complex structure of the forest, the algorithms themselves faced difficulty in differentiating between living and dead trees.

Using ‘deep learning’, which is a sub-field of machine learning, it is possible to improve the classification accuracy further beyond 80%. It mimics the function of neural networks in human brain and learns hierarchically, starting from the local patterns like leaves or branches of a tree to the complex scenes like the complete tree itself. Deep learning has the ability to accomodate a big amount of reference samples needed for the training phase. In order to speed up the process mentioned before, a computing platform consisting of powerful processor units as well as high-end graphics card is required. Only a select few research institutes might have access to this resource as it does not come cheap. Recently, cloud computing platforms such as Amazon Web Services (AWS) offer high performance virtual computers that can be accessed from anywhere in this world. The users only have to pay the exact time they spend with the resources, making it potentially cost-efficient for small-scale institutes or individuals. The CORSNAV Research Group ultimately uses benefits from the deep learning approach combined with the power of cloud computing to perform training faster while still producing higher classification accuracy.

“*Deep learning might sound unfamiliar to us at first. But after getting acquainted with the method provided from CORSNAV Research Group, getting improved accuracy in classifying tree species and deadwood has made us realize how important it is to our work here in Bavarian Forest National Park.* ”, said Marco Heurich, a representative from Bavarian Forest National Park. “*If you imagine how long it would take to perform forest inventory without the help from these technologies (ALS, deep learning). Not to mention that we have to spend more resources on manpower for surveying and on expensive workstation PCs. AWS has also made it possible for us to access high performance computing power that can be scaled to our needs while also cost-aware to our usage.”*

The tested workflow allows scientists to perform deep learning-based classification without having to worry about the complicated setup. An automation script is provided to help them run multiple experiments sequentially. The deep learning software library with its dependencies are saved in an isolated environment as a container image, which they can easily deploy in any Amazon Elastic Compute Cloud (EC2) instance, the virtual computer itself. Training data and the results can be stored in an Amazon Simple Storage System (S3) Bucket, a storage system which works independently from any EC2 instance. It is flexible to attach and detach without having to worry about the loss of data in case an EC2 instance suddenly crashes or shut down.

*“I’m just starting my research on a small forest area in India and it is really difficult to move the equipments with my team around here”, said a postgraduate student Felipe Mendoza. “I found out about this interesting method and without wasting any time, I asked the forest administration if they have an actual 3D data from ALS. Turns out they had just done a flight with a drone last month and were glad to share it. So I began to use the method to identify deadwood here, which I need for my statistics data.”*

To learn more about this method and how it can help your research projects, please contact Prof. Dr. Peter Krzystek via his Email: [peter.krzystek@hm.edu](mailto:peter.krzystek@hm.edu)

  