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Utilizing 15 cm Satellite Data for Tree Analysis

Technological advances in satellite imagery have unlocked new opportunities for analyzing trees and forests with high precision. Arboair **developed a new AI algorithm based on a game engine** which uses 15 cm satellite data from European Space Imaging, located in Munich, for a high-precision analysis of tree types and health, moisture levels, and topography. This innovation is a game-changer for forestry and urban planning, as it enables a **detailed, scalable analysis with a significant cost reduction**. Here, we explore the key outputs of employing such high-resolution satellite data: ground classification, tree databases, forest damage assessment, and felling optimization.

The presentation addresses the challenge of **improving efficiency and reducing environmental impacts**. It focuses on how very high-resolution (VHR) satellite data can optimize planting, monitor tree health, and guide harvesting decisions. The idea of using VHR Satellite data came up together with the company Arboair in Sweden. Arboair used drone data to analyze forests, but for larger forests in northern Europe, drones do not have the capacity to cover large areas. Also, aerial imagery can only be collected during a short season. VHR Satellite data can be collected throughout the growing season and **cover large areas within one day** even when conditions for airplanes are not favorable (wind, thermal activities etc).

Arboair developed an **innovative AI algorithm to process the data** – instead of using a massive amount of satellite data for training, they utilized the **Unreal game engine** to create training data for the AI algorithm.

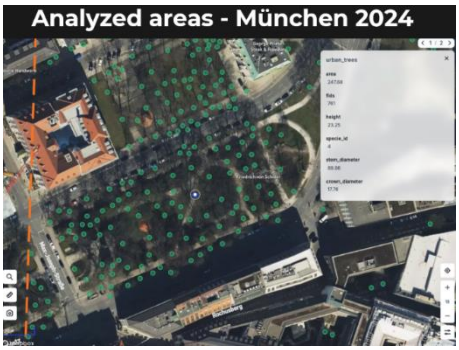
Arboair invests heavily in generating synthetic forest data for AI training, unlocking an expansive range of possibilities in image detection, including: **Unlimited Variation**, which allows the generation of large, diverse datasets to train robust and resilient models; **Detection Training on Rare Classes**, enabling identification of uncommon features that would be impractical without synthetic data; **Cost-Effective Scaling**, reducing expenses by avoiding costly fieldwork and repeated data acquisition; and **Flexibility and Customization**, providing the ability to tailor environments, conditions, and parameters to match evolving project needs.

Ground Classification: Optimizing Planting Strategies

Satellite data enables precise ground classification, offering insights into **existing tree types, moisture levels, and topography**. This information is critical for optimizing planting strategies. Forestry managers can identify ideal areas for specific tree species based on soil conditions and other environmental factors, leading to improved survival rates and sustainable forest development. Furthermore, this data aids in identifying areas prone to erosion or waterlogging, helping to mitigate risks before planting begins.

Tree-Level Database: Granular Tree-Specific Measures

A comprehensive tree-level database is one of the most transformative outputs of high-resolution satellite data. By analyzing individual trees, the system can measure parameters such as **tree height, crown diameter, and stem volume**. This granular data facilitates better inventory management, enabling forestry professionals to monitor growth rates and assess the health of specific trees. Such insights also empower stakeholders to track carbon sequestration efforts and biodiversity within forest ecosystems.



70% cost reduction

Especially in the field of urban forestry, municipalities will highly benefit from this approach as it will **reduce costs for manual creation of a tree database vs the satellite approach by about 70%.**

Forest Damages: Timely Identification and Intervention

One of the critical applications of 15 cm satellite data is identifying forest damages caused by storms, pests, diseases, or illegal logging. High-resolution imagery enables the **detection of subtle changes in tree health, such as discoloration or defoliation**. Early identification

of such damages helps save time, reduce losses, and protect valuable timber resources. Automated alerts from satellite monitoring systems ensure timely intervention, enhancing forest resilience and reducing restoration costs.

Felling Optimization: Sustainable Harvesting Practices

High-resolution satellite data plays a pivotal role in planning sustainable harvesting. By accurately estimating stem volume, tree diameter, and species distribution, this data enables forestry managers to identify optimal areas for felling. This approach **minimizes waste and ensures that only mature trees are harvested**, preserving young growth and maintaining forest balance. Moreover, detailed spatial analysis supports strategic road planning and reduces environmental impact during logging operations.

Conclusion

The innovation potential is significant, as this technology integrates cutting-edge imaging capabilities with data analytics to provide actionable insights. **Its precision and scalability make it a game-changer for forestry management globally.**

The integration of 15 cm resolution satellite data into forestry management heralds a new era of precision and sustainability. From optimizing planting strategies to managing tree-level databases, identifying damages, and planning sustainable harvesting, this technology offers unparalleled insights. By leveraging these capabilities, stakeholders like forestry managers, environmental conservationists, policymakers, timber industry players, and researchers focused on sustainable development, can enhance productivity, conserve ecosystems, and **achieve long-term environmental and economic goals**.

Conference participants will gain insights into advanced forestry management techniques, practical applications of satellite data, and how this technology can contribute to sustainability goals and economic efficiency. Mainly the approach of using 15 cm satellite imagery for large forest areas is not very common and only a niche product. The participants will benefit from getting insight into **a new approach and a new data source** for the needs of the stakeholders.

Feedback on the feasibility of implementation, potential barriers, and additional use cases for high-resolution satellite data in forestry and related fields is expected. Suggestions for enhancing data integration and stakeholder collaboration are also anticipated.