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Enhanced vine pruning thanks to artificial intelligence and augmented reality

Idiap Research Institute and the 3D2cut Swiss company developed a system capable of identifying vines and of assisting pruning. This project was supported by the The Ark foundation for innovation in Valais.

Vine pruning requires years of experience. Poor pruning can have catastrophic consequences for the health and productivity of the vine. To address the shortage of skilled and knowledgeable pruners, the startup 3D2cut asked Idiap to develop a system based on artificial intelligence and integrate it into augmented reality goggles. The device identifies the different structural parts of each individual vine plant and recommends precise cutting points. This work has been made possible thanks to the support from the Ark, a foundation for innovation based in Valais.

The vision system developed at Idiap allows identification of the structure of a vine plant. “We drew inspiration from the technologies used to detect human posture. Instead of predicting in an image both the key points of a human body, the device detects nodes on vine plants as well as the branches that connect them. It also determines the type of branches: trunk, spur, rods, shoots. Then, by defining the order of the nodes and spurs, you can apply an expert system to recommend where the pruning cuts should be made,” Jean-Marc Odobez, Head of the Perception & Activity Understanding group at Idiap, explains.

The system is based on a neural network specially designed for this task, and trained on vine images annotated by specialists. The final structure of the plant is extracted from these detections thanks to a new algorithm based on the research of a path of least resistivity of a graph. This method allows to adapt to the number of nodes and connections, unlike what is used for humans for whom the articulation structure is fixed.

A promising tool

A first version has been integrated and deployed by 3D2cut on a tablet and tested on real-life shots. For the experts, results are very encouraging. To offer reliable and efficient technology, many challenges remain. The vision system will have to work in different conditions and take into account aspects such as luminosity, variety of backgrounds including other vines, and viewing angles.

“Collaborating with Idiap has been invaluable. We have the technical knowledge regarding vines and the ability to collect large quantities of data, researchers bring us the necessary expertise in AI to quickly reach a solution,” Jérôme Corre, CTO of 3D2cut, explains. This partnership with the institute could prove even more fruitful in the future if the system is adapted to trees that also need pruning.

More information

- Demo video: <https://www.youtube.com/watch?v=3FDnoiuKu90>
- Scientific paper: <https://doi.org/10.1016/j.compag.2023.107736>
- 3D2cut: <https://www.3d2cut.com/>

Idiap Research Institute has been a world specialist in artificial intelligence for 30 years. Voice and visual recognition, human–computer interaction, robotics, and language analysis are just some of the Institute’s fields of expertise. Based in Martigny, Switzerland, Idiap is engaged in local, national, and international projects. The non-profit Idiap Foundation was created in 1991 by the city of Martigny, the State of Valais, the l’Ecole polytechnique fédérale de Lausanne (EPFL), the University of Geneva, and Swisscom.

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