Session 1

Using artificial intelligence for grapevine yield forcasts

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In viticulture yield is closely linked to the quality of the grapes/wine and determines the economic viability of a vineyard. In general terms: the higher the yield the lower the wine quality. Yield is therefore one of the most important parameters for wine production and needs to be in a good equilibrium with the procuction goals. Until now, yield estimation is usually done manually and is prone to errors. Yield is influenced by a various parameters like genotype, soil, weather, and vineyard management. Estimation errors in viticulture occur to be on average of +/- 30%. The goal of this study is to use artificial intelligence to improve yield forecasts in viticulture and grapevine breeding.

In a first step for a more accurate yield forecast system three main sources of data are taken into account by the artificial intelligence (AI): (1) long-term yield data, (2) environmental data (soil and weather) as well as (3) process management data. In a second step the AI is extended and further improved by sensor-based feature acquisition. For this purpose, yield-relevant characteristics are recorded directly in the vineyard in real time by the „PHENOboxx“ which is an Embeded-Vision-System. The most important characteristics include the quantification of shoots, bunches and the mass of dormant pruning wood as well as the nutrient and chlorophyll content of the leaves. The „PHENOboxx“ is placed on the „Phenoliner“, a converted grape harvester used for data collection and as a phenotyping platform for grapevine research. In addition, the soil in the corresponding plots is recorded by using the “Stenon” sensor.

During data gathering and validation for step one first inconsistencies in recorded data have been found. The allocation of yield data to individual plots turned out to be very difficult, as this data were not recorded precisely enough for individual plots wthin the past 16 years. To overcome this issue, yields from one vinegrower from plots with the same variety were aggregated to obtain an adjusted yield per hectare. Existing weather data gathered from the weather station is also very heterogonous over the last 16 years, allocation to single plots is been done by distance to the weather station. Process management data is only available for certain plots.

It can be said that historic data must be screened very carefully before taken into the modeling process. So far, the AI can forecast yields up to 74% correct just by using the historic data without adding any sensor measures in the vineyard.

In the long run, sensor data acquisition will improve the AI and needs to be carried out casually during standard vineyard work on the tractor to improve yield forecasts and therefor quality management in viticulture.