Towards paddy rice smart farming: A review on big data, machine learning, and rice production tasks

ABSTRACT

Big Data (BD), Machine Learning (ML) and Internet of Things (IoT) are expected to have a large impact on Smart Farming and involve the whole supply chain, particularly for rice production. The increasing amount and variety of data captured and obtained by these emerging technologies in IoT offer the rice smart farming strategy new abilities to predict changes and identify opportunities. The quality of data collected from sensors greatly influences the performance of the modelling processes using ML algorithms. These three elements (e.g., BD, ML and IoT) have been used tremendously to improve all areas of rice production processes in agriculture, which transform traditional rice farming practices into a new era of rice smart farming or rice precision agriculture. In this paper, we perform a survey of the latest research on intelligent data processing technology applied in agriculture, particularly in rice production. We describe the data captured and elaborate role of machine learning algorithms in paddy rice smart agriculture, by analyzing the applications of machine learning in various scenarios, smart irrigation for paddy rice, predicting paddy rice yield estimation, monitoring paddy rice growth, monitoring paddy rice disease, assessing quality of paddy rice and paddy rice sample classification. This paper also presents a framework that maps the activities defined in rice smart farming, data used in data modelling and machine learning algorithms used for each activity defined in the production and post-production phases of paddy rice. Based on the proposed mapping framework, our conclusion is that an efficient and effective integration of all these three technologies is very crucial that transform traditional rice cultivation practices into a new perspective of intelligence in rice precision agriculture. Finally, this paper also summarizes all the challenges and technological trends towards the exploitation of multiple sources in the era of big data in agriculture.