TOWARD PREDICTION OF AGRICULTURAL TRAITS USING MULTI-OMICS MODEL

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For decade, next generation sequencer (NGS) has been intensively developed to reach current big data genomics field. Comparing to traditional/manual observation method, the high-throughput methods are accumulating large and high-quality data set trying to cover majority of life phenomena that we have noticed. The 'Omics' terms such as genome, transcriptome, epigenome, interactome, metabolome, metagenome, and etc. have been suggested and advanced to reveal new opportunities to understand deeper biology. However, from these big biology data we also can observe such high degree of life complexity that force us to implement interdisciplinary researches with various field such as computer science, statistics, artificial intelligence (machine learning).

Among these "outer" technologies, the artificial intelligence (AI) is referred as even "4th industrial revolution" as it solved one of most difficult prediction problems, "Baduk". Beside of the famous winning on "Baduk", AI also can solve difficult problems of image/pattern recognitions and some of the models showed that it could surpass human eye recognitions. Our Omics data for major crops including rice and soybean consisted with reference genome, transcriptome from many tissues and conditions, whole genome genotypes of populations from various artificial crosses and natural germplasms. Moreover, we intensively collected the phenotypes of the populations to map the important loci for crop breeding. Notably, high-throughput phenotyping system became realization for high-quality and almost real time phenotype data. These multi-level Omics data can be regarded as the complex patterns that AI may recognize to predict agricultural traits in near future.

Here, we explain the schematic concept of AI application in crop breeding especially for trait predictions and show the trials of Omics-based prediction using AI algorithms. Furthermore, we will suggest ultimate goal for data-driven crop breeding using AI and the strategies how to achieve the goal.

Keywords: Multi-Omics, machine learning, artificial intelligence, phenotype prediction