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National Agriculture and Food Research Organization (NARO)

BANDAI NAMCO Research Inc.

Development of Smart-Breeding Evaluation Method Using Drones and AI
-AI program automatically selects favorable grass samples on behalf of breeders-

The National Agriculture and Food Research Organization (NARO), in collaboration with BANDAI NAMCO Research Inc., has developed a grass breeding evaluation method using drones and artificial intelligence (AI) deep-learning, that can act as a substitute for breeders. Until now, breeders have had to visit the field directly and evaluate the characteristics of grass manually using a process which can take upwards of 2 hours. With this technology, an AI can perform the same evaluation using images taken from drones in approximately 5 mins.

Overview

NARO, in collaboration with BANDAI NAMCO Research Inc., has developed an automated evaluation method using AI for selecting favorable strains of grass by studying the techniques of skilled breeders. Up until now, breeders have had to visit the field and manually evaluate grasses visually for upwards of two hours. But, by using this new method, AI trained using deep-learning provided with images taken via drones is able to perform the same task in approximately 5 minutes.

NARO has a proven track record in the field of grass cultivar development, such as with the high sugar content orchardgrass "Esajiman" and the festulolium high wintering cultivar "North fest". Using this experience, they have developed a new breeding evaluation method using drones. By incorporating advanced ICT/AI technology developed by BANDAI NAMCO Research Inc. in the entertainment field, this cutting edge breeding evaluation method was developed.

Due to the ever-increasing scale of livestock consumption in japan it is necessary to improve productivity in the sector by implementing ICT and robotics technologies. Efficient breeding of forage crops is a means to achieve this goal. The development of this method is expected to accelerate the development of favorable new grass cultivars.

Publication

Yukio Akiyama, Hiroyuki Nashida, Naoya Suzuki and Yasuharu Sanada, 2020: Development of a new evaluation method for individual selection in breeding of Dactylis glomerata L. with Unmanned Aerial Vehicle (UAV) and Deep Learning. ***Breeding science.*** DOI:https://doi.org/10.1270/jsbbr.19J07

Reference Information

Fig.1 Drone used for shooting

Fig.3 Aerial image of breeding field (one section)

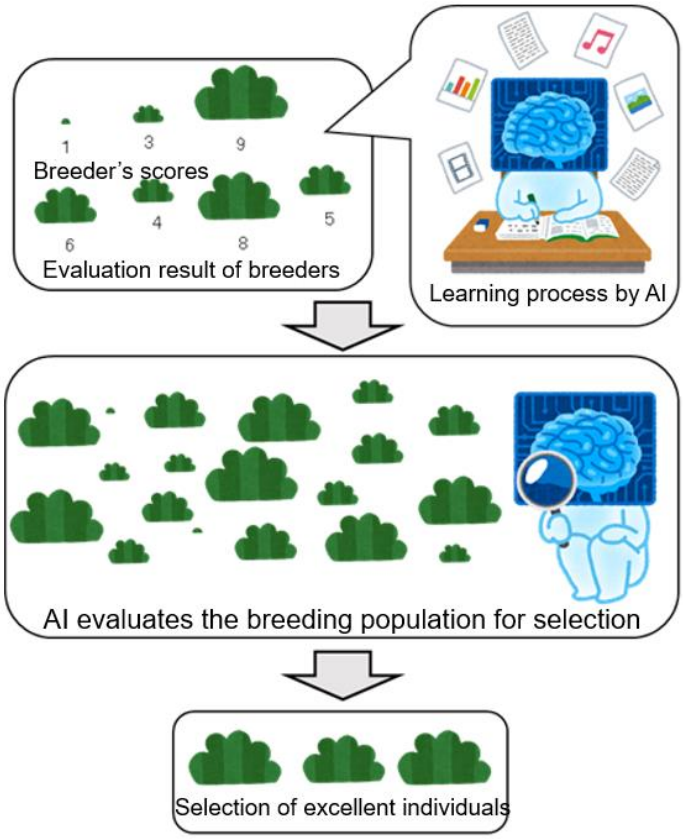

Fig. 2 Conceptual diagram of selection of excellent individuals using AI

Table 1-Correct answer of breeding evaluation results by trained AI

		Correct answer rate (%) at each correct answer acceptable point (± X) *	
Evaluation date	Evaluation item**	±0	±1
160825	Plant vigor	55.0	91.3
161101	Plant vigor	52.7	95.9
161117	Plant vigor	43.8	92.5
170428	Plant vigor	67.5	98.8
170510	Plant vigor	58.8	95.0
170523	Plant vigor	45.0	86.3
180718	Plant vigor	48.6	93.3
180807	Plant vigor	62.9	96.2
180821	Plant vigor	64.8	100.0
180903	Plant vigor	45.7	92.4
180912	Plant vigor	55.2	97.1
170424	Winter hardiness	45.0	95.0
170425	Winter hardiness	48.0	94.7
180423	Winter hardiness	60.0	97.5
180426	Winter hardiness	58.1	98.6
160825	Disease tolerance	25.0	70.0
160912	Disease tolerance	46.3	86.3
160929	Disease tolerance	60.0	98.8
181009	Disease tolerance	41.0	87.6

Data with low Disease tolerance were surveyed when features were less visible in the images.

*) Correct answer acceptable point "± 0" indicates that the breeder's score matches that of AI, and "± 1" indicates that the score is within ± 1 point of error.**)

**) Plant vigor (index for predicting yield, 1: extremely poor - 9: extremely good)

Disease tolerance (index for disease status, 1: minor - 9: severe)

Winter hardiness (index for successful wintering, 1: extremely poor - 9: extremely good)