

Artificial Intelligence Development for Detection of Plant Pathogenic Fungal Spores

- Miyu Matsuyama, Hiroshi Uematsu, Yoichi Motokura, Kiyooki Maeda, Takayuki Matsuura (Plant Protection Station, Ministry of Agriculture, Forestry and Fisheries (MAFF))

Introduction and purpose of research

- Uromyces betae* (Pers.) Tul. (= *U. beticola*) is a rust fungus (obligate plant pathogen) that affect beet production.
- This pathogen occurs in Asia (excluding countries such as India and China), most European countries, and some U.S. states, but **it has not been reported in Japan.**
- To prevent the introduction of this seed-borne pathogen, **we inspect imported beet seeds.** (See image 1)
- However, the current inspection process is **time-consuming** and **labor-intensive.** (See image 2)
- To address this issue, we developed an **Artificial Intelligence (AI)** diagnostic model using **deep learning** to identify *U. betae* spores.

Methods

- AI model was **trained** and **validated** with a large number of identified **images of *U. betae* urediniospores, teliospores, and beet pollen.**
- The trained AI model was tested on the test dataset composed of identified images to evaluate its diagnostic accuracy and confidence. (See image 3)

Results and discussion

- The trained AI model **successfully distinguished urediniospores, teliospores, and pollen with high accuracy and confidence.**
- The model also has **real-time diagnostic capabilities.** (See image 4)
- The trained AI model is currently **undergoing validation testing for implementation in the inspection.**

