

## Automatic image recognition of microfossils using Artificial Intelligence

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Deep learning, using the multilayered neural networks, is a form of a broader family of machine learning methods learning data representations which is a subset of Artificial Intelligence (AI). A combination of the deep learning method and image recognition potentially enables to recognize microfossil taxa in microscopic images automatically. Here we present the application of the AI software to microfossil images. The AI software "RAPID machine learning" (NEC Ltd.) was applied into recognition of six species of Quaternary calcareous nannofossils: *Emiliana huxleyi*, *Gephyrocapsa oceanica*, *Gephyrocapsa ericsoni*, *Reticulofenestra haqii*, *Gephyrocapsa caribbeanica*, and *Reticulofenestra producta*. First, we captured 300 optical polarization images each of the six species. Using a training dataset consisting of randomly selected 30 images for each taxon, an auto-recognition model was built by RAPID. Subsequently, the model predicts taxa in a testing dataset of the other 20 images per each taxon to test if the 6 taxa could be recognized correctly. As a result, the percentage of correct classification of *G. oceanica* and *R. haqii* were very high as 100% and 95%, respectively. On the other hand, the other 4 species could not be discriminated, showing that 0–35% of the images were correctly classified. We also would like to introduce the AI applications for discrimination of microfossils other than calcareous nannofossils and to discuss the possibility of automatic recognition.

Keywords: Machine learning, Taxonomy, Microfossils, Artificial intelligence