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Artificial neural networks for clustering sediment grains in microphotographs.

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Paleoreconstruction is a group of methods for evaluating geophysical parameters based on indirect indicators, such as the chemical composition of foraminiferal shells, the concentration of various gases in sedimentary grains on the ocean floor, etc. For example, with the distribution of types and sizes of foraminifera or sizes and shapes of crystals of various minerals in sediment deposits, one may reconstruct the temperature and salinity of water and even the direction and speed of currents. A number of methods are used to explore sediment particle composition nowadays: examining color characteristics, physical properties of grains, their isotopic composition, etc. However, the visual examination of sedimentary particles under a microscope remains one of the most exploited methods. In our study, we consider sediments' fraction of size from 100 microns under an 80x microscope. Our study aims to infer the distribution of sizes and shapes of the grains in a sediments sample. However, the problem we face is that it takes a great time and effort of an expert to classify the particles. In our study, we propose to employ artificial intelligence methods for automating this task. We collect optical imagery of prepared sediment samples. Using the images, we collect visual representations of different grains of sediments. We propose using a version of convolutional variational autoencoder for reducing the dimensionality of the visual representations. Then we apply a clustering algorithm for splitting the grains into groups of similar ones. An expert examines the groups for further classification.

In this work, we will demonstrate the preliminary results of the clustering of sedimentary particles and outline further development of the presented method for their automated classification.

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