Summary

In this thesis, we present the current state of image processing for the purpose of machine learning, software containerization and the deployment of intelligent models. We present a comprehensive software solution consisting of an environment for training the machine learning model, web and mobile applications, in which we deploy the resulting intelligent model for easy use. We implement the training environment and the web application using technologies that are not demanding on computing power and reduce the demands on the required storage, within a containerised Docker Compose solution. We obtain mushroom photographs from publicly available sources with free licenses. From the obtained photos, we built a dataset of 24 classes of mushrooms, designed for training and testing.

Using an iterative process, we create our own convolutional neural network design. We have created a binary classifier of edible and inedible mushrooms, also a classifier of 24 classes of mushrooms. Because of unsatisfactory results of the custom models, we used transfer learning techniques for the deployed model - we used an experimental process to select a suitable candidate from the models available in the Keras library. Using technique of fine-tuning, we achieve a test accuracy of 97% with the model DenseNet121. We subsequently tested the model with another dataset obtained by Python scripts from Google Images, in which we monitor the test accuracy of 86%.

We consider the mobile application for the Android operating system to be a key point in the deployment of the resulting model. The application serves as a companion for mushroom picking (thanks to its high accuracy), whereas it contains a short article about each of the dataset's mushroom type, a reference image of the said mushrooms for visual comparison and information about the edibility of the mushrooms. The application does not require an internet connection to make predictions, it minimizes the hardware requirements of the device by efficient architectural design and uses the GPU on supported devices for faster inference.

In the web application, we apply the same philosophy to minimize requirements, using a more efficient and less demanding inference environment directly from the creators of the TensorFlow library (TensorFlow Serving), instead of the assignment-specified Django framework. Looking at the resulting software project, we can declare the set goals of this thesis fulfilled. The plan of future work should include research for simpler - semi-automatic editing of obtained photographs, creation of a larger dataset using generative adversarial networks, and the implementation of a mobile application in a hybrid application framework such as Flutter, which produces the resulting applications for Android and iOS operating systems from the same source code.