**Astana IT University**

**Classification of mushrooms for Kazakhstan using Deep Learning**

Kenzheakhmetov B., Zhanibekova Z.

Instructor: Yeleu Sultanmurat

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**Abstract**: The Mushroom Classification application for Kazakhstan utilizes Convolutional Neural Networks (CNN) to accurately classify mushrooms commonly found in Kazakhstan. The app aims to help users distinguish between edible and poisonous mushrooms, reducing the risk of accidental mushroom poisoning.

**Introduction**: Mushroom poisoning is a significant concern in Kazakhstan, where many people forage for mushrooms in the wild. This app provides a solution to this problem by leveraging deep learning techniques to classify mushrooms based on images.

**Literature review**

This review examines two key papers on the development of deep convolutional neural networks (CNNs) for image recognition:

"ImageNet Classification with Deep Convolutional Neural Networks" (Krizhevsky et al., 2012): This seminal work introduced a deep CNN architecture that achieved state-of-the-art performance on the ImageNet image classification challenge. The authors employed a network with five convolutional layers, followed by pooling layers and fully connected layers, achieving significant improvement over previous methods.

"Very Deep Convolutional Networks for Large-Scale Image Recognition" (Simonyan & Zisserman, 2014): Building upon the success of Krizhevsky et al. (2012), this paper proposed even deeper CNN architectures, demonstrating further improvement in image recognition accuracy. The authors introduced the VGGNet architecture, which utilized considerably more convolutional layers (up to 19) compared to previous models.

**Key Findings and Contributions**: Both papers demonstrate the effectiveness of deep CNNs for image recognition, achieving significantly higher accuracy than previous approaches.

Krizhevsky et al. (2012) pioneered the use of deep CNNs with effective training techniques, paving the way for further advancements in the field.

Simonyan & Zisserman (2014) pushed the boundaries of depth in CNN architectures, showcasing the potential of even deeper models for improved performance.

**Impact and Significance**: These works have had a profound impact on the field of computer vision, marking a significant leap forward in image recognition capabilities. Deep CNNs, inspired by these advancements, have become the dominant approach for various computer vision tasks, including object detection, image segmentation, and image generation.

**Future Directions**: While deep CNNs have achieved remarkable performance, ongoing research continues to explore further improvements in accuracy, efficiency, and robustness. Potential areas of exploration include:

Development of novel network architectures that are even deeper and more efficient.

Incorporation of techniques like transfer learning and domain adaptation to improve performance on diverse datasets.

Exploration of interpretability methods to understand how deep CNNs arrive at their decisions.

These advancements hold the potential to further revolutionize the field of computer vision and its applications in various real-world domains.

**Dataset**: The dataset comprises six classifications of mushrooms, encompassing both edible and poisonous varieties. Each classification includes 160 images of mushrooms commonly found in Kazakhstan, with each class labeled with the corresponding mushroom species.

**Methodology**:

Data Preprocessing: Images are resized to a uniform size of 180\*180 and normalized to improve model performance.

Model Architecture: Our final project based on the knowledge and materials we gained while doing assignment 2, where we used CNN architecture. A CNN architecture is used for classification, consisting of convolutional layers followed by max-pooling layers. The final layer uses a softmax activation function for multi-class classification.

Training: The model is trained on a 100\*6 images of the dataset, using techniques such as data augmentation to improve generalization.

Validation: The model is validated on a 60\*6 images of the dataset to assess its performance.

Testing: The final model is tested on a new set of 20 \* 6 images to evaluate its accuracy.

**Results**: The model achieves an accuracy of 89% on the test dataset, demonstrating its effectiveness in classifying mushrooms. The app provides users with the predicted class of the mushroom along with a confidence score.

**Conclusion**: The Mushroom Classification application for Kazakhstan demonstrates the potential of deep learning in addressing real-world problems. By providing users with a tool to identify mushrooms, the app can help prevent mushroom poisoning and promote safe foraging practices.

**References**

Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). Imagenet classification with deep

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