**DEEP LEARNING BASED CAT BREED CLASSIFICATION**

**[1] A. Ahmeda, H. Yousifa, R. Kaysb, and Z. Hea:** This paper focuses on animal object detection and species classification in camera-trap images collected in highly cluttered natural scenes. Using a deep neural network (DNN) model training for animal- background image classification, we analyze the input camera-trap images to generate a multi-level visual representation of the input image. We detect semantic regions of interest for animals from this representation using k-mean clustering and graph cut in the DNN feature domain. These animal regions are then classified into animal species using multi-class deep neural network model. According the experimental results, our method achieves 99.75% accuracy for classifying animals and background and 90.89% accuracy for classifying 26 animal species on the Snapshot Serengeti dataset, outperforming existing image classification methods.

**Summary:** This paper focuses on animal object detection and species classification in camera-trap images collected in highly cluttered natural scenes. Using a deep neural network (DNN) model training for animal- background image classification, we analyze the input camera-trap images to generate a multi-level visual representation of the input image. We detect semantic regions of interest for animals from this representation using k-mean clustering and graph cut in the DNN feature domain. These animal regions are then classified into animal species using multi-class deep neural network model.

**[2] B. Kong, J. Supanci˘ c, D. Ramanan, and C. C. Fowlkes:** We investigate the problem of automatically determining what type of shoe left an impression found at a crime scene. This recognition problem is made difficult by the variability in types of crime scene evidence (ranging from traces of dust or oil on hard surfaces to impressions made in soil) and the lack of comprehensive databases of shoe outsole tread patterns. We find that mid-level features extracted by pre-trained convolutional neural nets are surprisingly effective descriptors for this specialized domains. However, the choice of similarity measure for matching exemplars to a query image is essential to good performance. For matching multi-channel deep features, we propose the use of multi-channel normalized cross-correlation and analyze its effectiveness. Our proposed metric significantly improves performance in matching crime scene shoeprints to laboratory test impressions. We also show its effectiveness in other cross-domain image retrieval problems: matching facade images to segmentation labels and aerial photos to map images. Finally, we introduce a discriminatively trained variant and fine-tune our system through our proposed metric, obtaining state-of-the-art performance.

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**[3] M. Zhanyu, Y. Ding, S. Wen, J. Xie, Y. Jin, Z. Si, and H. Wang:** Identifying shoe-print impressions in the scene of crime (SoC) from database images is a challenging problem in forensic science due to the complicated impressing surface, the partial absence of on-site impressions, and the huge domain gap between the query and the gallery images. The existing approaches pay much attention to feature extraction while ignoring its distinctive characteristics. In this paper, we propose a novel multi-part weighted convolutional neural network (MP-CNN) for shoe-print image retrieval. Specifically, the proposed CNN model processes images in three steps: 1) dividing the input images vertically into two parts and extracting sub-features by a parameter-shared network individually; 2) calculating the importance weight matrix of the sub-features based on the informative pixels they contained and concatenating them as the final feature, and; 3) using the triplet loss function to measure the similarity between the query and the gallery images.

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**[4] L. Xie, Q. Tian, R. Hong, S. Yan, and B. Zhang:** As a special topic in computer vision, fine-grained visual categorization (FGVC) has been attracting growing attention these years. Different with traditional image classification tasks in which objects have large inter-class variation, the visual concepts in the fine-grained datasets, such as hundreds of bird species, often have very similar semantics. Due to the large inter-class similarity, it is very difficult to classify the objects without locating really discriminative features, therefore it becomes more important for the algorithm to make full use of the part information in order to train a robust model. In this paper, we propose a powerful flowchart named Hierarchical Part Matching (HPM) to cope with fine-grained classification tasks. We extend the Bag-of-Features (BoF) model by introducing several novel modules to integrate into image representation, including foreground inference and segmentation, Hierarchical Structure Learning (HSL), and Geometric Phrase Pooling (GPP). We verify in experiments that our algorithm achieves the state-of-the-art classification accuracy in the Caltech-UCSD-Birds-200-2011 dataset by making full use of the ground-truth part annotations.

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**[5] T. Berg and P. Belhumeur**: From a set of images in a particular domain, labeled with part locations and class, we present a method to automatically learn a large and diverse set of highly discriminative intermediate features that we call Part-based One-vs.-One Features (POOFs). Each of these features specializes in discrimination between two particular classes based on the appearance at a particular part. We demonstrate the particular usefulness of these features for fine-grained visual categorization with new state-of-the-art results on bird species identification using the Caltech UCSD Birds (CUB) dataset and parity with the best existing results in face verification on the Labeled Faces in the Wild (LFW) dataset. Finally, we demonstrate the particular advantage of POOFs when training data is scarce.

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