Positively Identifying Species Using CNNs and Hypernetworks to Aid Wildlife Conservation Efforts

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Positively identifying endangered species has been a global challenge in wildlife conservation efforts. Traditional methods such as morphological means of identification require expert knowledge. Modern biotechnological tools require extensive infrastructure and capital resources. Convolutional Neural Networks have shown immense promise in classifying images. As a first step towards creating a solution, CNNs were trained to identify images of species and of their artifacts, like footprints or feces. However, CNNs have a severe limitation - they require several images for training. These images are unavailable for countless endangered species that play vital roles in ecosystems. Very few images, often only one, have ever been taken of these species. To overcome this problem, a new approach has been proposed, using a hypernetwork. The hypernetwork takes a single image of a common species as an input and outputs another neural network – a classifier. During training, backpropagation is performed on the classifier and gradients are computed and squared. These are used as the loss for the hypernetwork, with which it is trained. This is repeated for several images and several species. After training, an image of a rare species can be given to the hypernetwork to generate a classifier that can identify other images of that species. In one test of the method, dog breeds were considered. The mean accuracy of the classifiers produced by the hypernetwork was 90%. The test results showed that this solution can be used to identify endangered species. When put alongside traditional CNNs in an app, it can be effective in curbing poaching and trafficking, monitoring wildlife populations, and analyzing diversity. It can also be used offline in remote areas.

Awards Won:
Fourth Award of $500
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