Application of a Deep Learning Image Classifier for Identification of Amazonian Fishes

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Abstract

1. Given the sharp increase in agricultural and infrastructure development and the paucity of widespread data available for making conservation management decisions, a more rapid and accurate tool for identifying fish fauna in the world's largest freshwater ecosystem, the Amazon, is needed. 2. Current strategies for identification of freshwater fishes require high levels of training and taxonomic expertise for morphological identification or genetic testing for species recognition at a molecular level. 3. To overcome these challenges, we built an image masking model (U-Net) and a convolutional neural net (CNN) to classify Amazonian fish in photographs. Fish used as training data were collected and photographed in tributaries in seasonally flooded forests of the upper Morona River valley in Loreto, Peru in 2018 and 2019. 4. Species identifications in the training images (n = 3,068) were verified by expert ichthyologists. These images were supplemented with photographs taken of additional Amazonian fish specimens housed in the ichthyological collection of the Smithsonian's National Museum of Natural History. 5. We generated a CNN model that identified 33 genera of fishes with a mean accuracy of 97.9%. Wider availability of accurate freshwater fish image recognition tools, such as the one described here, will enable fishermen, local communities and community scientists to more effectively participate in collecting and sharing data from their territories to inform policy and management decisions that impact them directly.

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Actual (Family) Genus

Characiformes

- Iguanodectidae, Bryconops
- Characidae, Charax
- Tetragonopterus
- Astyanax
- Bario
- Hemmigrammus
- Hyphessobrycon
- Moenkhausia
- Creagrutus
- Knodus
- Tyttocharax
- Phenacogaster
- Crenuchidae, Characidium
- Curimatidae, Curimata
- Erythrinidae, Erythrinus
- Gasteropelecidae, Gasteropelecus
- Lebiasinidae, Copella
- Pyrrhulina
- Prochilodontidae, Prochilodus
- Serrasalmidae, Pygocentrus

Gymnotiformes

- Gymnotidae, Gymnotus

Siluriformes

- Aspredinidae, Bunocephalus
- Auchenipteridae, Tatia
- Callichthyidae, Corydoras
- Doradidae, Doras
- Heptapteridae, Pimelodella
- Loricariidae, Otocinclus
- Oxyropsis
- Ancistrus
- Rineloricaria
- Pimelodidae, Sorubim

Cichliformes

- Cichlidae, Apistogramma
- Bujurquina

Predicted Genus: Bryconops, Charax, Tetragonopterus, Astyanax, Bario, Hemmigrammus, Hyphessobrycon, Moenkhausia, Creagrutus, Knodus, Tyttocharax, Phenacogaster, Characidium, Curimata, Erythrinus, Gasteropelecus, Copella, Pyrrhulina, Prochilodus, Pygocentrus, Gymnotus, Bunocephalus, Tatia, Corydoras, Doras, Pimelodella, Otocinclus, Oxyropsis, Ancistrus, Rineloricaria, Sorubim, Apistogramma, Bujurquina

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