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NCTS# 28919-18 AGU 2017
New Orleans, LA
Abstract 02 – 12/14/17

“A 3D Active Learning Application for NeMO-Net, the NASA Neural Multi-Modal Observation and Training Network for Global Coral Reef Assessment”

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NeMO-Net, the NASA neural multi-modal observation and training network for global coral reef assessment, is an open-source deep convolutional neural network and interactive active learning training software aiming to accurately assess the present and past dynamics of coral reef ecosystems through determination of percent living cover and morphology as well as mapping of spatial distribution. We present an interactive video game prototype for tablet and mobile devices where users interactively label morphology classifications over mm-scale 3D coral reef imagery captured using fluid lensing to create a dataset that will be used to train NeMO-Net's convolutional neural network. The application currently allows for users to classify preselected regions of coral in the Pacific and will be expanded to include additional regions captured using our NASA FluidCam instrument, presently the highest-resolution remote sensing benthic imaging technology capable of removing ocean wave distortion, as well as lower-resolution airborne remote sensing data from the ongoing NASA CORAL campaign.

Active learning applications present a novel methodology for efficiently training large-scale Neural Networks wherein variances in identification can be rapidly mitigated against control data. NeMO-Net periodically checks users' input against pre-classified coral imagery to gauge their accuracy and utilize in-game mechanics to provide classification training. Users actively communicate with a server and are requested to classify areas of coral for which \ other users had conflicting classifications and contribute their input to a larger database for ranking. In partnering with Mission Blue and IUCN, NeMO-Net leverages an international consortium of subject matter experts to classify areas of confusion identified by NeMO-Net and generate additional labels crucial for identifying decision boundary locations in coral reef assessment.