GALAXY CLASSIFICATION

Morpheus's big dreams
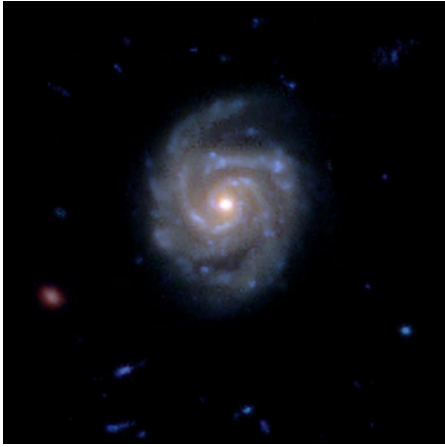
Credit: NASA/STScI and Ryan Hausen

Galaxies come in many shapes and sizes. Their morphology is connected to the physics of galaxy formation, providing information on the initial conditions, large-scale tidal fields, merger and accretion history, star formation, influence of supermassive black holes, and so on. Galaxy classification therefore forms the basis of this field of study. Humans are good at sorting and classifying, as demonstrated by the Galaxy Zoo project. But with large surveys such as the Legacy Survey of Space and Time expected to capture billions of galaxies, machine learning techniques that can increase the speed and capacity will be vital. To this end, Ryan Hausen and Brant Robertson have created a deep learning model, Morpheus, for generating morphological classifications of astronomical sources at the pixel level.

Morpheus is a ground-up approach that applies semantic segmentation, adopted from computer vision research. This technique takes each pixel in an image and assigns a class label to it; for example, Morpheus identifies which pixels are likely to be associated with a source and separates them from the sky pixels. Morpheus is further trained to identify sources as 'spheroid' (pictured, reddish blob to the left of the central disk), 'disk' (pictured, centre), 'irregular', 'point source/compact' and 'background'; for disks with a central bulge, the disk and bulge are classified separately. The program both detects and classifies objects, which are then colour-coded based on their morphology; for complicated deep-field images, this method is very powerful.

The data are publicly released, along with tutorials and data products, to bring semantic segmentation algorithms to a wider audience.

May Chiao