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Modern AI is powerful but brittle. Although deep learning models can correctly classify hundreds of different classes of images with near human-level performance, they fail dramatically when they encounter an image from a new class. This is a big problem in real-world applications of AI, where the world is open and new data and new classes are the norm. The goal of this research is to develop new AI models that robustly identify and adapt to open world novelty using a modeling approach called Bayesian non-parametrics which naturally posit an open world.