To survive in dynamic environments, it is critical to detect changes that signal the presence of rewards to be collected by taking an action. In previous work, mice were trained on an image change detection task, where eight images were presented in brief, repeated presentations (Garrett et al., 2020). In a given presentation, the image could be the same as the last presentation, or it could change, in which case a water reward could be collected by licking a spout. The firing rates of three types of visual cortical neurons were recorded using two-photon calcium imaging. Using classical averaging of neural activities, this past work revealed that area SLC contains image-selective excitatory neurons. However, it remained unclear whether inhibitory SST and VIP neurons show similar image-selectivity or if they are primarily sensitive to image change. In this project, we aimed to decode image identity from neural firing rates in each of these visual areas. We also investigated whether deep neural network architectures (MLP, CNN) could outperform standard machine learning methods (SVM). First, we trained these decoders on a subset of data from only the repeated image presentations, holding out the initial presentations as an out-of-distribution dataset. We find evidence that image identity information is encoded in SST inhibitory neurons. However, the decoding performance for these neurons drops considerably when tested on the out-of-distribution initial presentations, suggesting that these neurons may respond differently to image change versus repeated-image recognition. This was supported by a follow-up analysis in which we aimed to decode whether a neuron was responding to the first or second presentation of an image. Lastly, our results demonstrate the effectiveness of CNNs for neural decoding using time-series activity of multiple neurons, where high feature dimensionality can thwart standard machine learning methods.