The Optogenetic stimulation of neurons in the primary visual cortex (V1) is a novel and promising technique for vision restoration for people with acquired blindness. One of the challenges of such a technique is finding artificial stimuli which invoke desired cortical activities. This thesis explores whether neural networks and deep learning can be used for reverse engineering artificial stimuli patterns for optogenetic cortical implant prosthesis (LED) from cortical activity pattern recordings, assuming that similar cortical activity recordings are caused by similar visual stimuli. Various DNN architectures outperforming baseline solutions in stimulus reconstruction will be explored. Loss functions such as MSE and Structural similarity (SSIM) will be used. Questions such as if loss of information in the high-frequency domain of the reconstructed stimuli negatively affects correspondence between the desired cortical activity and the activity elicited by artificial stimuli patterns will be investigated. MSE evaluation metric will be used to determine the degree of similarity between the two types of cortical activities. Due to the limited availability of biological data, we use a model of V1 combined with a model of optogenetic cortical prosthesis (LED) and stimulation developed by Antolík et al. [2021] to simulate cortical activity under various stimuli.