Representing Bionic-Vision Devices in the Neural Electronic Interface Ontology – Abstract

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Abstract

Devices such as retinal and cochlear implants improve the quality of life for those suffering from vision or hearing loss. These devices interface with the central nervous system to enhance (or augment) stimuli from the patient's external environment. However, there are major obstacles to the effective use of this technology. Standards are lacking for defining the types of devices used for this purpose, the conditions under which these devices should be employed, the assessment of patients' sensory ability, and the metrics for evaluating the performance of these devices. For example, due to the lack of precise epidemiological data to distinguish between low and ultra- low vision levels, it is difficult to estimate the number of suitable vision loss patients. To address these needs, we are developing the Neural Electronic Interface Ontology (NEIO). NEIO uses ontological principles to address these challenges. Genus-differentia definitions, taxonomic hierarchies, and formal relations precisely define the different kinds of neural-interface devices. Such definitions include device components and functions, and the pathological conditions that these devices address. Where relevant, we reuse classes from other ontologies in order to leverage the expertise of the developers of these ontologies and promote interoperability. For example, we use Uberon to represent the anatomical locations where the devices are implanted. We are using data from bionic-visions.org to create classes to represent the bionic-vision devices, relevant components of these devices, and the organizations that produce them. We are currently adding measures of visual ability. These measures will enable comparisons between outcomes from various sight restoration methods. The comparison classes include bionic-vision devices, gene therapy, stem-cell therapy, and pharmaceuticals. This work forms the foundation of an ontological framework to represent the assessment of visual ability. This framework will, in turn, facilitate the identification of appropriate vision restoration procedures for patients with a variety of eye diseases, thereby optimizing patient outcomes. Finally, although NEIO is currently focused on bionic vision, NEIO aims to provide a semantic framework for representing the domain of neural electronic interface technology in general.

Keywords

Ontology, Neural-Interface Devices, Bionic Vision, Retina Implant

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