Ontological Analysis of MS Patient-Reported Affective Outcomes Versus Motor Functioning

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Introduction

Multiple Sclerosis (MS) is an autoimmune disease that causes the demyelination of neurons in the brain and has a variety of symptoms (e.g. limb pain and vision loss). MS patients in the New York State Multiple Sclerosis Consortium (NYSMSC) registry fill out an enrollment form and self-report the severity of their symptoms. Our previous work created a Multiple Sclerosis Patient Data Ontology (MSPD) with classes based on the NYSMSC enrollment form and allowed analysis of significant trends in how certain patient subsets experience MS symptoms compared to the overall NYSMSC population. While our earlier study only focused on patients reporting more severe symptoms, the current work analyzes results from all patients with symptoms of any severity. We visualize our analysis using an enhanced graphing technique simultaneously displaying low, intermediate, and high levels of reported symptoms for selected patient subsets.

Methods

We used Protégé to update the class names and definitions in MSPD to represent a broader range of symptom severity and performed all subsequent steps using Python scripts. We annotated the NYSMSC data by sorting the patients based on the severity of their self-reported symptoms and creating datasets listing each de-identified patient ID and the ontology classes for their symptoms in each severity level; the enrollment form asked patients to report their symptoms on a numeric scale, so we created low, intermediate, and high levels based on the scale. We then used term enrichment, an analysis technique used with other ontologies, to select a subset of patients and compare the proportion of that subset reporting a symptom at a certain level to the proportion of the overall population reporting the same symptom. We used GraphViz to display the MSPD ontology and incorporated color gradients to display the term enrichment p-values associated with each class.

Results and Discussion

In Figure 1, we sorted the patients based on their Expanded Disability Status Scale (EDSS) score, a clinical measure of patients’ physical limitations; higher scores mean higher levels of limitation. Compared to the overall patient population, we found a seemingly counter-intuitive point: patients with lower scores reported negative emotions (e.g. stress, agitation) more frequently, whereas patients with higher scores reported life satisfaction at a higher rate compared to the patient population as a whole. Our continuing work includes: visualizing trends for different patient subsets, examining factors affecting these trends (e.g. the influence of pharmacological treatments for MS on patients’ perceptions of the disease), and presenting these analyses to clinicians so they may better treat their patients based on our results regarding patterns in the data associated with different populations.

Reference and Acknowledgments