

Machine Learning using causal inference as a pipeline to identify drug label expansion candidates from real-world data

Yishai Shimoni

IBM Research – Haifa, Israel



Abstract

Label expansion for on-the-market drugs has huge financial and clinical potential, since it bypasses much of the time-consuming and expensive parts of the drug development process. Historically, identifying such opportunities often required serendipitous identification of positive effects of one treatment over a non-indicated outcome. The large amounts of real-world clinical data that are recently becoming available provide an opportunity to identify such effect in a systematic way, either paving the way to designing clinical trials for label expansion with a high probability of success; or allowing to test hypotheses on real data with minimal risk. Such a data-driven approach, however, presents challenges in that it contains inherent treatment bias, which may confound the observed differences in treatment effect. We have developed a pipeline that utilized causal inference methodology to address these biases and correct for them. We then identify multiple candidates for drug repurposing or label expansion that have a strong foundation in real-world results. We recently applied this pipeline to identify candidates for repurposing in Parkinson's disease, identifying an insomnia drug that seems to have a beneficial effect for delaying the onset of dementia in these patients



Biography

Yishai Shimoni was born in Jerusalem, Israel in 1974. He received his BSc in physics and computer science from the Hebrew University in Jerusalem (HUJI) and continued to do his MSc and PhD in physics at HUJI, receiving his PhD in 2008. He was a postdoctoral fellow at Mount Sinai hospital in New York, and then received a junior faculty position at Columbia University in the systems biology department before moving to IBM Research in Israel in 2015. He authored 25 papers and 4 patents, and released two open-source packages, one in R and one in python. His research in the last few years is focused around applying causal inference methods to clinical retrospective data.

Publications

1. A discriminative approach for finding and characterizing positivity violations using decision trees
2. RW3 framework for reliable value assessment of treatments using causal analysis of observational data: support matching biological therapy to rheumatoid arthritis patients
3. Comment: Causal Inference Competitions: Where Should We Aim?
4. Benchmarking framework for performance-evaluation of causal inference analysis
5. Association between expression of random gene sets and survival is evident in multiple cancer types and may be explained by sub-classification

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