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### Reflections on the Externship

At the beginning of the second week, my externship supervisor Nick Reich invited me, Jordan, and Will to dinner at a small restaurant called Mission Cantina. My fellow externs had joked about the fact that there weren't any good restaurants in Northfield, but Amherst was different. This dinner was special – not only did Nick pay the bill, but he invited his colleagues Steve and Xi (both Ph. D students in Biostatistics) so that we could discuss life, philosophy, and applied math.

This truly was an enlightening experience for me; I had never before sat down with graduate students and talked about their research. Ever since the University of Massachusetts acquired the technological resources to tentatively implement resource-intensive agent-based statistical models, there has been a lot of research on campus. It is no surprise that Nick and his crew set up their lab there, taking historical data from the CDC on influenza-like illness and predicting the future of outbreaks.

Early in the externship, Professor Reich showed us his real-time website which graphically displays each model's prediction for each week of the year. These predictions are what Nick's lab is all about – his team is one of many that submits their forecasts every year to the CDC as part of an official challenge.

From the conversation that we had over dinner and the various presentations and classes to which Nick brought us, I gathered that the main issue facing Nick is not just generating three component models (KDE, KCDE, and SARIMA models) independently. In order to increase the robustness of his predictions, Nick has to weigh them appropriately and concatenate them into an

ensemble model. Using a degenerate EM algorithm, Nick makes the ensemble model a defining piece of his work<sup>1</sup>.

Learning about Biostatistics has made me believe that the Reich Lab is an excellent resource for any future externs interested in graduate school. Giving me exposure to graduate-level topics such as MCMC methods, model stacking versus Bayesian neural networks in weight determination, missing data, and statisticians' search for the most parsimonious models, the externship was highly beneficial to me. Furthermore, I learned a lot about other interesting topics such as dengue fever.

I think that this externship is great for any student who is interested in higher-level math and statistical approximations of reality. Although it has in fact decreased my interest in the developing field of Biostatistics, I believe that it is great because Nick really makes an effort to make the work non-repetitive, complex, and intriguing. From a conceptual standpoint, I have fulfilled all my learning plan goals. And while I need more advanced math in order to understand the methods that Nick uses, I believe that I have learned quite a lot.

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<sup>1</sup> Evan L. Ray and Nicholas G. Reich, "Prediction of infectious disease epidemics via weighted density ensembles," *Department of Biostatistics and Epidemiology, University of Massachusetts, Amherst, MA, USA*, March 31, 2017, 4-7, <http://reichlab.io/pdfs/publications/ray-density-ensembles.pdf>.

**Literature Cited:**

Ray, Evan L., and Nicholas G. Reich. "Prediction of infectious disease epidemics via weighted density ensembles." *Department of Biostatistics and Epidemiology, University of Massachusetts, Amherst, MA, USA*, March 31, 2017, 1-21. <http://reichlab.io/pdfs/publications/ray-density-ensembles.pdf>.