Automatic Dynamic Relevance Determination

of soil properties over different soil layers for yield prediction using APSIM

- APSIM can predict yield for a given soil, weather, and land management configuration.
- There are more than 30 input variables to set, but some are better predictors than others.
- Many of those variables are functional inputs (e.g., soil water absorption at different depths).

  Are input values equally relevant across different soil layers?
- We could use a statistical emulator (AKA surrogates or meta-models) to address the question, but most current approaches would favor treating the input as an unstructured vector.
- Worry not! We extend current approaches and propose an **Automatic Dynamic Relevance Determination** (ADRD) covariance function for Gaussian processes (GP) equipped with a length-scale function that
  - determines the dynamic relevance of the input automatically of course :),
  - recognizes the intrinsic structure of the functional input,
  - captures how fast input predictive relevance transitions to a neutral state,
  - and it's super cool! You should check the poster for an application, I'll be happy to (try to) answer your Qs.

Spoiler: In our application on Maize, the top 8.8m keeps 99% of the predictive relevance for soil water absorption and an ADRD GP has a smaller out of sample prediction RMSE than a vector-input GP.

Luis Damiano, Jarad Niemi
Department of Statistics