



# Visualizing sensitivity analysis, savvy?

An interactive visualization tool for high dimensionality sensitivity analysis data in Python

Chris Fu, Blake Hough, Swapil Paliwal

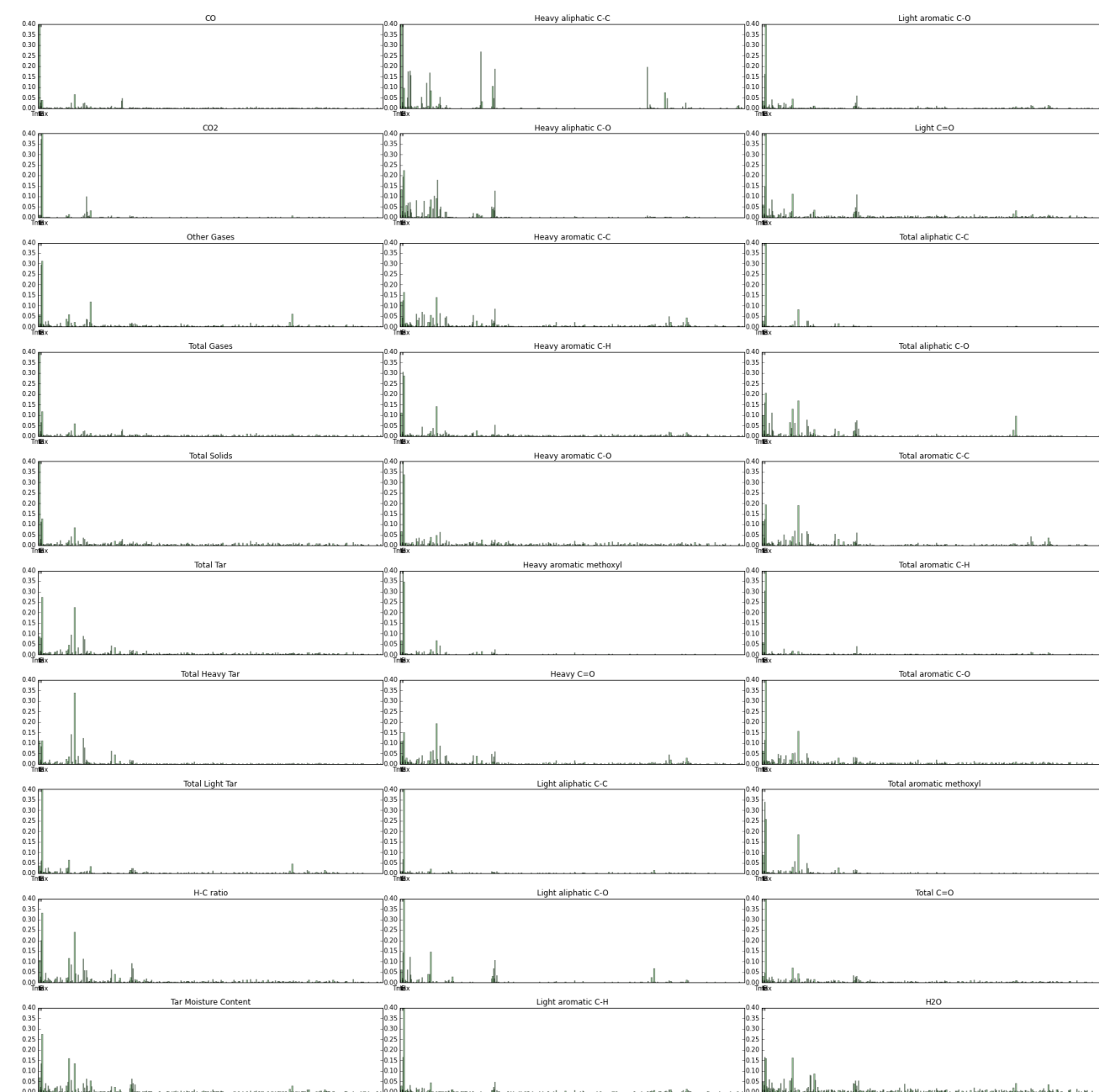


## Motivation

savvy is a package that works on any sensitivity dataset, but it was motivated by a specific project. We have a mathematical model which simulates lignin pyrolysis and predicts values for 30 output measures of interest.

End users would like to know certain output measures precisely, but have limited time or resources to invest in generating the best estimates for the 410 input parameters.

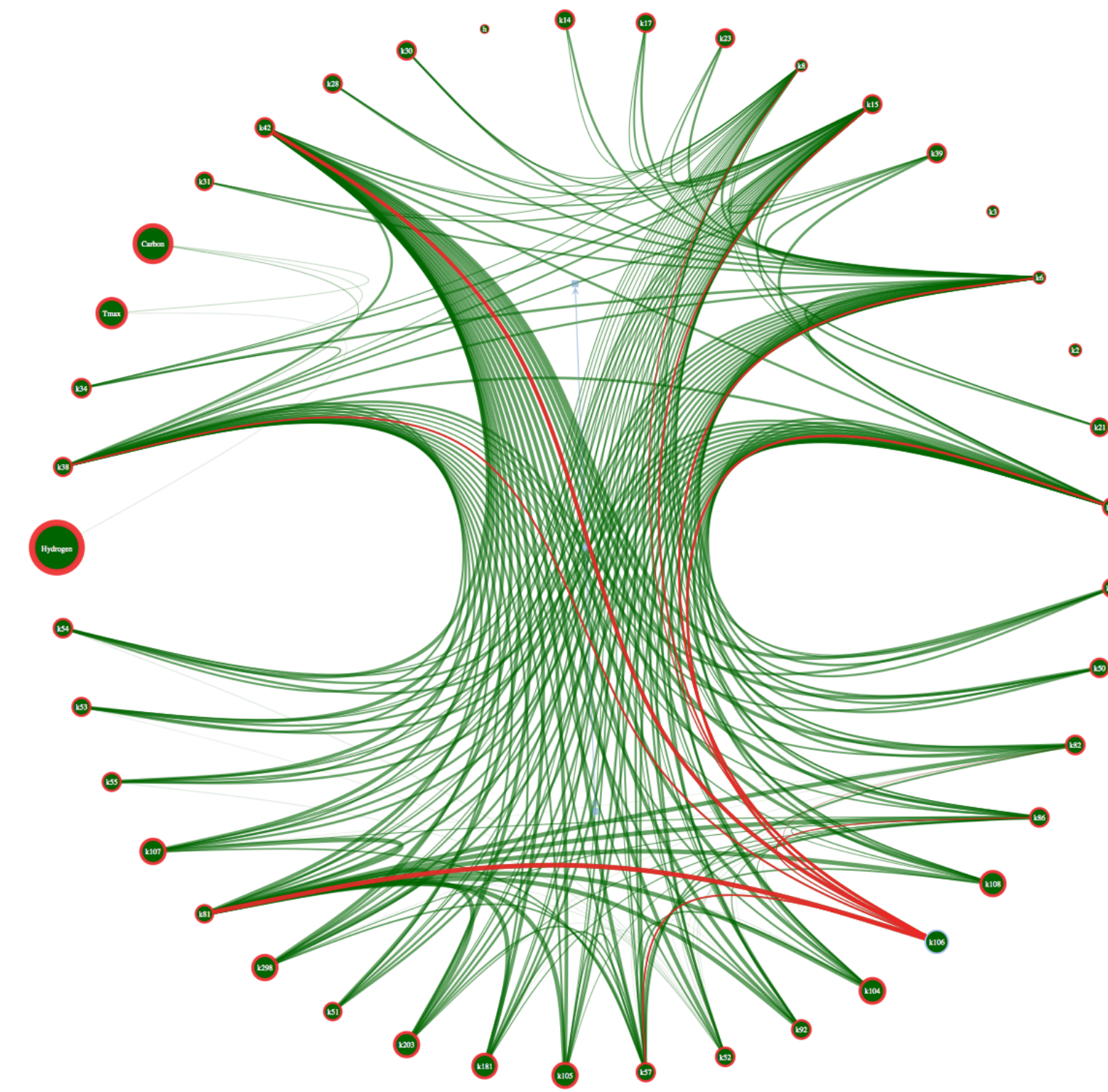
Sensitivity analysis can inform decisions about which parameters should be optimized, and which can be ignored. Unfortunately, exploring the results for high dimensional analysis is challenging with basic visualizations:



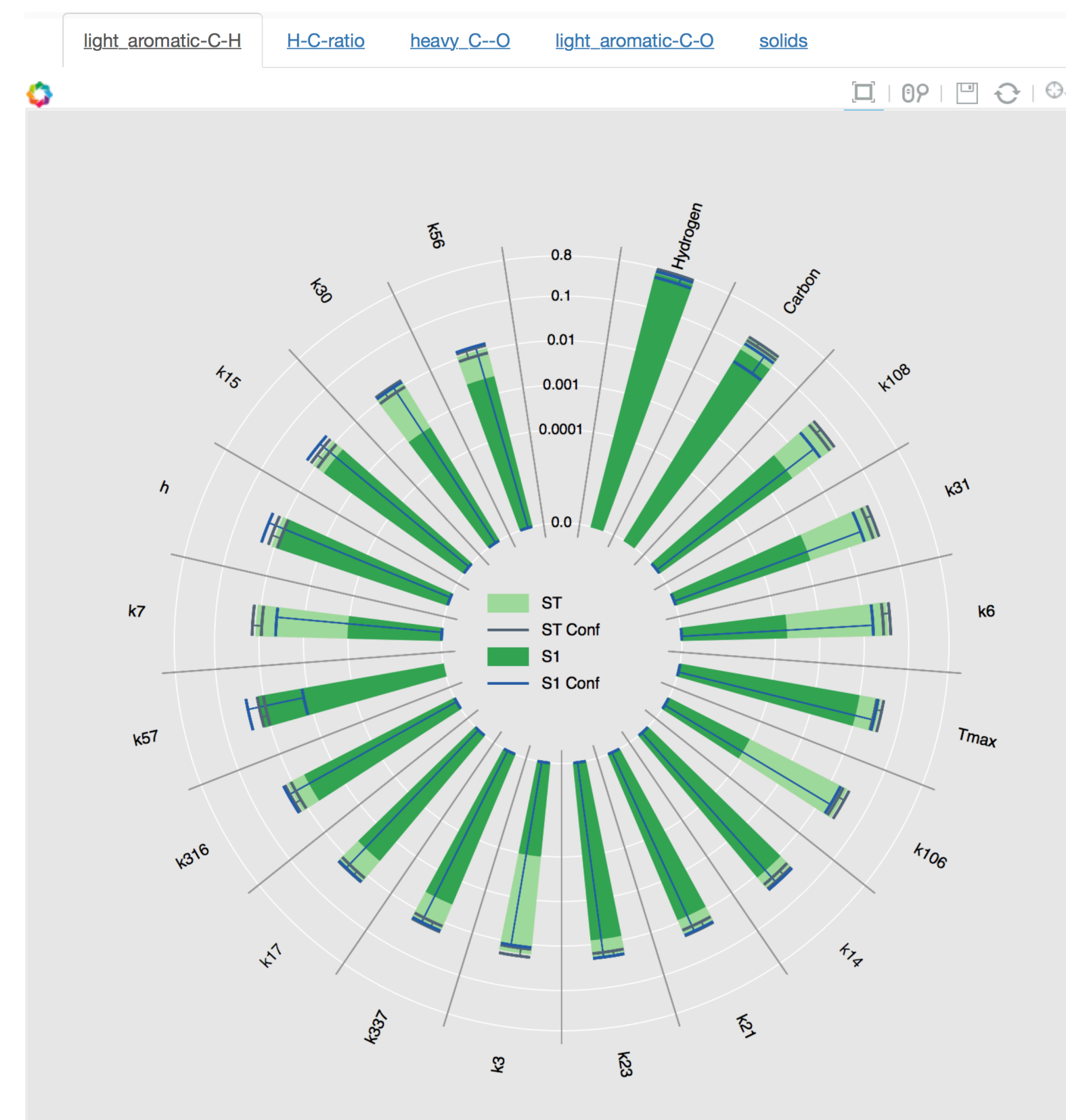
## Sobol Sensitivity Analysis

savvy contains a wrapper for SALib, a python package for performing variance-based global sensitivity analyses. It returns sensitivity indices that measure the contribution of input parameters to the variance in model output.

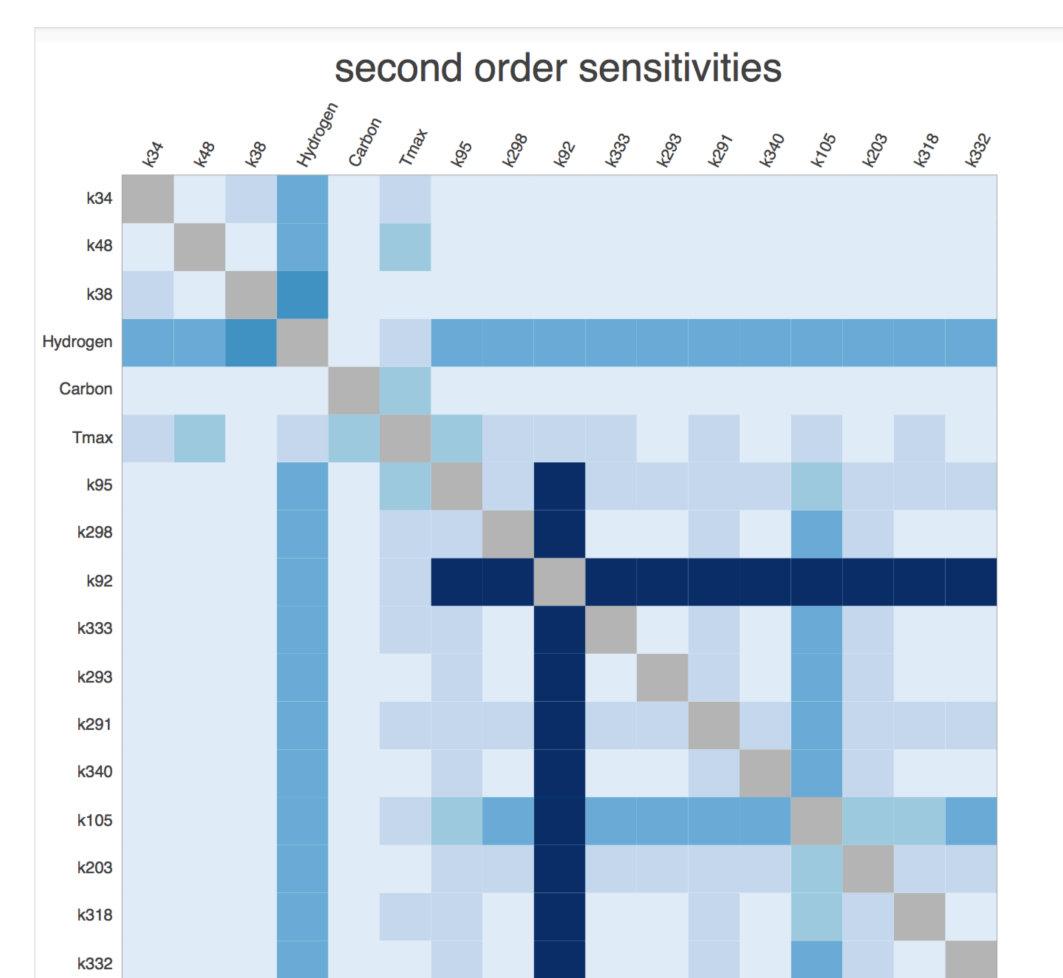
- 1<sup>st</sup> order indices: contribution to output variance by a single model input alone.
- 2<sup>nd</sup> order indices: contribution caused by interactions of two model inputs.
- Total order indices: contribution to output variance caused by 1<sup>st</sup>, 2<sup>nd</sup>, and all higher order interactions.



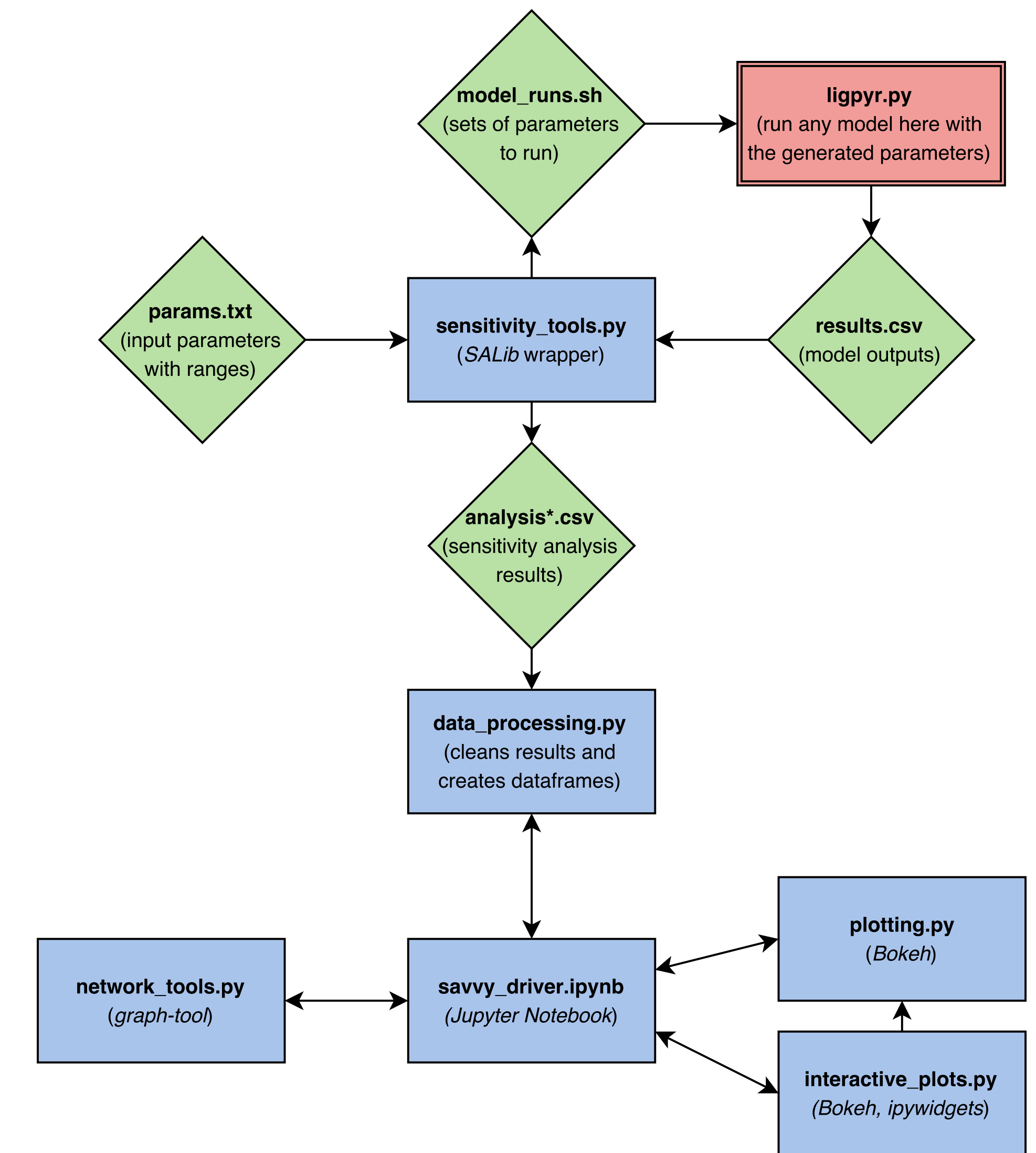
Total and second order sensitivities



First and total order sensitivities



Second order interactions



## Features of savvy

- Perform sensitivity analysis using SALib for any model of the user's choice.
- Cleans and processes SALib output for visualization.
- Multiple interactive visualizations:
  - Radial plots of the first and total order indices
  - Bar charts for low dimensional data
  - Heatmap for the sensitivities to second order interactions
  - Network plot showing first or total order sensitivities and the second order interactions between parameters

## Requirements

- Python 2.7
- SALib
- pandas
- NumPy
- matplotlib
- Bokeh
- graph-tool
- Jupyter notebook

## Acknowledgements

We would like to thank our instructors for their time outside of class helping us brainstorm and troubleshoot while working on this project. We would also like to thank SALib's author, Jon Herman, for his quick responses when we had questions about SALib.