

# An Approach to Global Sensitivity Analysis: FAST on COCOMO

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# Predictor Models in Software Engineering

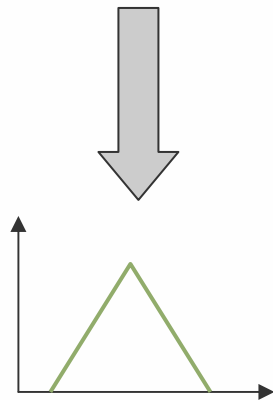
- Predict various properties of a project or software system
- Various types, aims, ...
- Examples: Defect estimation, development & maintenance cost prediction, etc.
- Problems
  - The models can be complex
  - Their use requires a lot of effort
  - How can I analyse those models themselves?
  - How can I simplify them?
  - How do I improve their predictive power?

# Global Sensitivity Analysis

- Saltelli (2000): “Sensitivity analysis studies the relationships between information flowing in and out of the model.”
- How do the input parameters influence the output?
- How can this influence be quantified?
- Global properties
  - Inclusion of influence of shape and scale
  - Multidimensional averaging
- Global analysis usually variance-based (e.g. FAST)
- “model-free”
- Analysis on the basis of sensitivity indices
  - Main or first-order effect
  - Higher-order effects (interactions)
  - Total effect

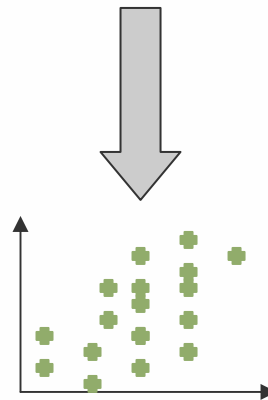
# Global SA for SE

Determining  
distributions



Input  
distributions

Visualising using  
scatterplots



Scatterplots

Analysing global  
sensitivity



A table with three rows and one column, containing numerical values representing sensitivity indices. The values are 0.8231, 0.0123, and 0.0033.

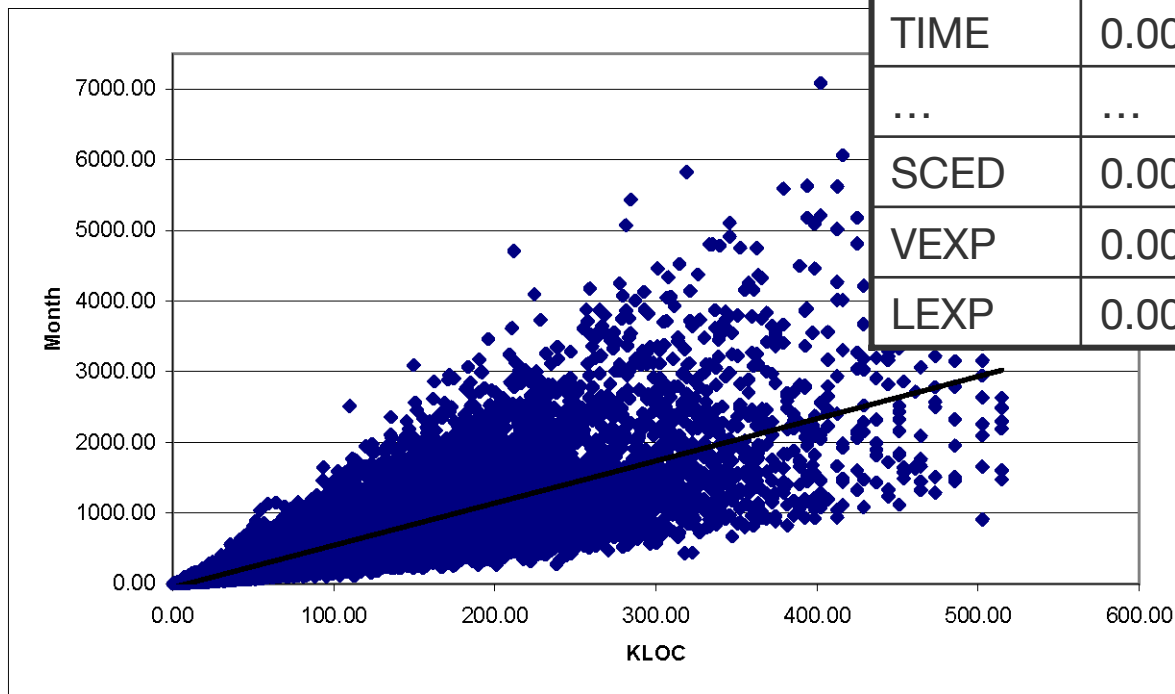
0.8231
0.0123
0.0033

Sensitivity  
indices

# Case Study: COCOMO

- Well-known and widely applied effort prediction model
- Public data from PROMISE data sets

First Order		Total Order	
size	0.5926	size	0.8690
b	0.0454	b	0.2616
TIME	0.0096	TIME	0.1633
...	...	...	...
SCED	0.0007	DATA	0.1291
VEXP	0.0007	TOOL	0.1266
LEXP	0.0003	RELY	0.1194



# Conclusions

- Sensitivity analysis useful tool for predictor models
- SA can help to
  - find errors in the models
  - simplify the models
  - identify interactions between input parameters
  - identify parameters that should be investigated more
  - get more robust predictions
- Experience with
  - reliability model
  - QA economics model
  - process model
  - expert system for IT tools
- Good tool-support available (Simlab: <http://simlab.jrc.cec.eu.int/>)