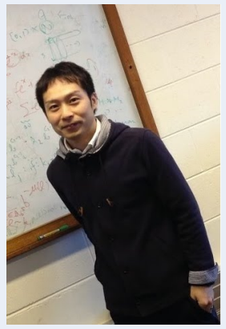
Goda Research Group

Department of Systems Innovation
School of Engineering, The University of Tokyo

This research group is a subgroup of Sato-Kobayashi-Goda joint laboratory.

Members: as of May 12, 2021

- **Takashi Goda**
  (Associate Professor, right)
- **5** graduate students
  (D2 **1**; M2 **3**; M1 **1**)
- **2** undergraduates students



Research:

- Uncertainty quantification
- Various Monte Carlo methods
  (from theory to application)
- Numerical analysis
- Machine/deep learning
- (More broadly) Mathematics & computation

Recent topics:

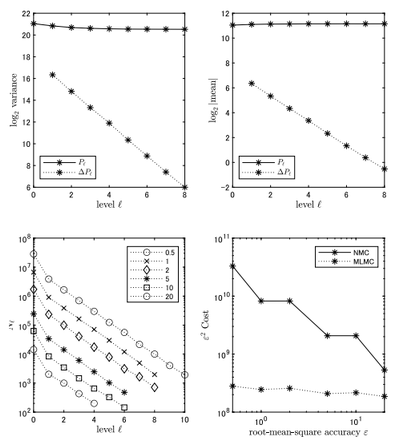
Goda research group is mainly interested in **Mathematics & Computation** related to **Uncertainty Quantification**.

1. Value of information

(M. Giles, TG, 2019)
(T. Hironaka, M. Giles, TG, H. Thom, 2020)

Motivated by applications to (medical) desision making under uncertainty, we have proposed an efficient Monte Carlo estimator for the expected value of information:

$$\mathbb{E}_Y\left[\max_{d\in D}\mathbb{E}_{\theta|Y}\left[f_d(\theta)\right]\right]-\max_{d\in D}\mathbb{E}_\theta\left[f_d(\theta)\right]$$



2. Sensitivity analysis

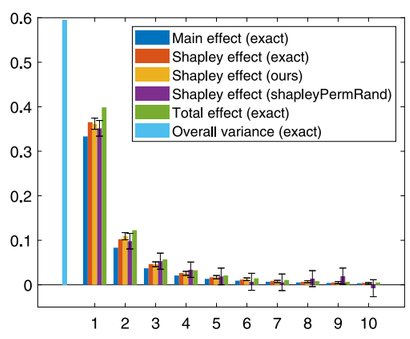
(TG, 2021)

We have proposed a simple algorithm to estimate a sensitivity measure called *Shapley effect* for global sensitivity analysis.

$$\phi_j=\sum_{\substack{\emptyset\neq u\subseteq\{1,\ldots,d\}\\ j\in u}}\sigma_u^2/|u|$$

where $\sigma_u^2=\mathbb{E}_{\boldsymbol{x}_u}\left[(f_u(\boldsymbol{x}_u))^2\right]$ with

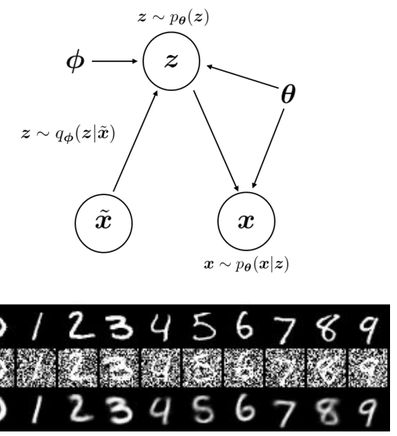
$$f(\boldsymbol{x})=\sum_{u\subseteq\{1,\ldots,d\}}f_u(\boldsymbol{x}_u).$$



3. Machine learning

(K. Ishikawa, TG, 2021)
(T. Moriyama, master's thesis, FY2020)

Variational Bayes/autoencoders are a method to find a good approximation of posterior distribution of latent variables from parametric family. We have proposed a new learning algorithm which directly looks at the marginal log likelihood.



Note that we are even proceeding with several other projects.

Major publications:

- K. Ishikawa, TG, *UAI 2021*, accepted.
- J.Dick, TG, H. Murata, *Statistics and Computing*, 2021.
- TG, *Reliability Engineering & System Safety*, 2021.
- T. Hironaka, TG, M.B. Giles, H. Thom, *SIAM/ASA Journal on Uncertainty Quantification*, 2020.
- TG, T. Hironaka, T. Iwamoto, *Stochastic Analysis and Applications*, 2020.
- M.B. Giles, TG, *Statistics and Computing*, 2019.

Contact:

Email: goda@frcer.t.u-tokyo.ac.jp

Web: https://sites.google.com/site/takashigoda/