Machine Learning and Statistical Data Analysis

Sugiyama-Yokoya-Ishida Lab

{sugi, yokoya, ishi}@k.u-tokyo.ac.jp

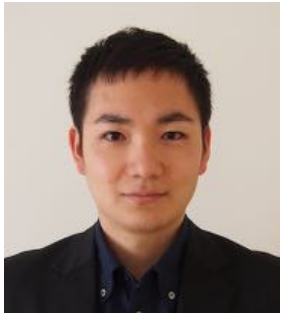
http://www.ms.k.u-tokyo.ac.jp

東京大学
THE UNIVERSITY OF TOKYO

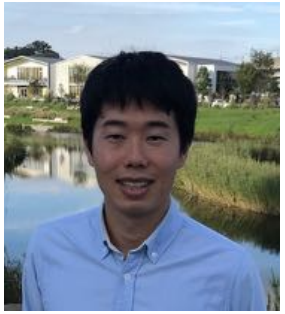
Faculty Members

- Masashi Sugiyama (Professor)
  - Machine learning algorithms
  - Industrial applications

- Naoto Yokoya (Lecturer)
  - Image processing
  - Remote sensing



- Takashi Ishida (Lecturer)
  - Weakly supervised learning
  - Regularization



Staffs' Affiliations

- Graduate School of Frontier Sciences (K)
- Graduate School of Information Science and Technology (H)
- Faculty of Science (H)
- The Institute for AI and Beyond (H)
- RIKEN Center for Advanced Intelligence Project (N)

Current members in our lab:
Research & support staffs: 8
Doctoral students: 22
Master students: 23

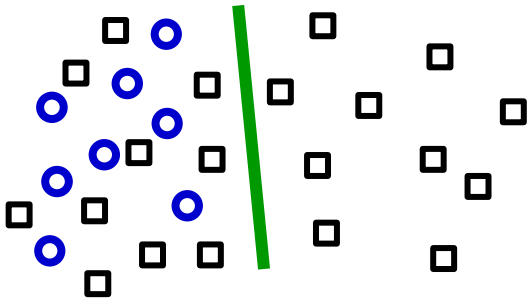
(including former Prof. Sato's students)

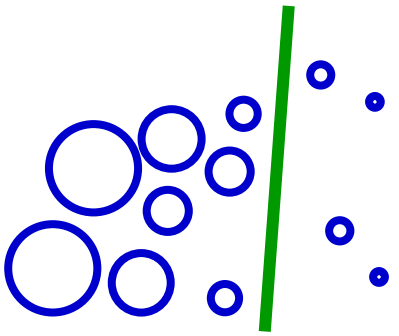
How Intelligent Can Computers Be?

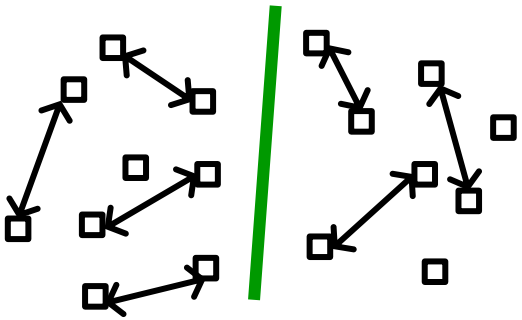
- We are interested in machine learning:
  - Construction of fundamental theories.
  - Development of practical algorithms.
  - Application in real-world problems.

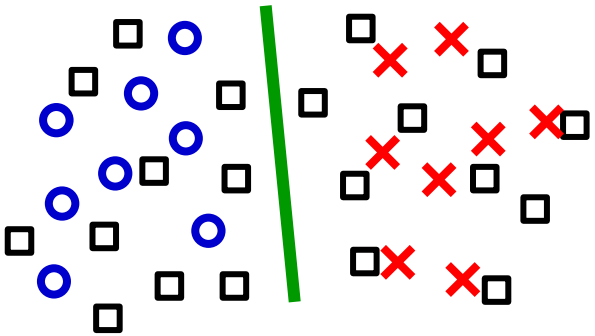
Recent Research Topics

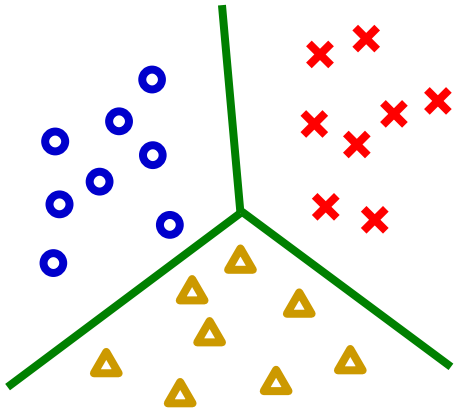
- Weakly supervised learning:
  - Labeling data is costly.
  - But learning from small data is generally difficult.
  - Let's utilize "weak" data that can be collected easily!
  - Examples: PU, PNU, Pconf, UU, SDU, Comp. learning, etc.







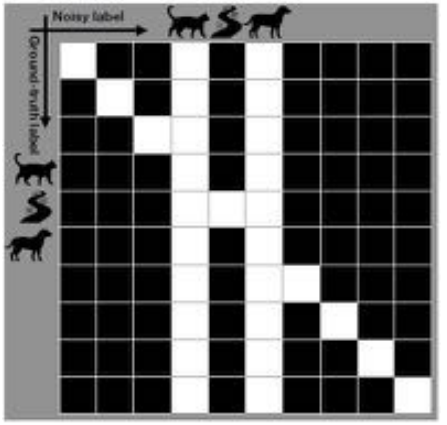


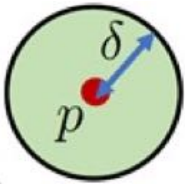


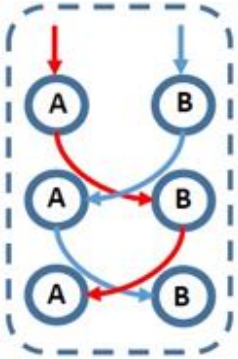
Recent Research Topics

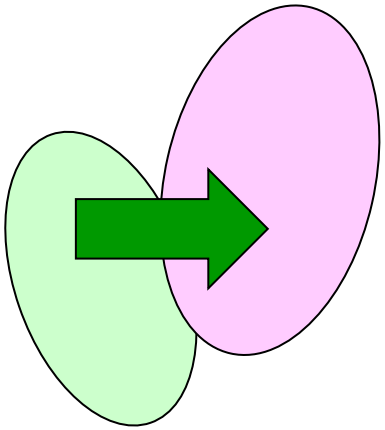
Robust and reliable learning:

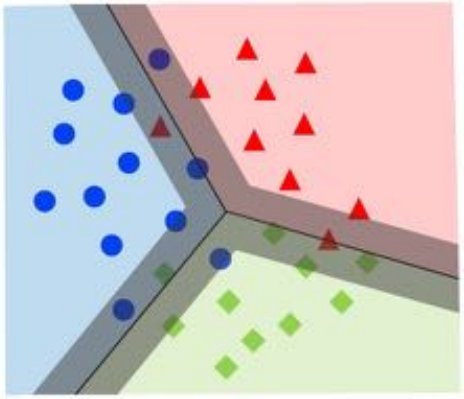
- Data is often contaminated by noise, outlier, non-stationarity, etc.
- Standard machine learning methods do not work well with such data.
- We are developing new technologies that can overcome these difficulties.
- Examples: Co-teaching, label-noise learning, classification with rejection, transfer learning, etc.





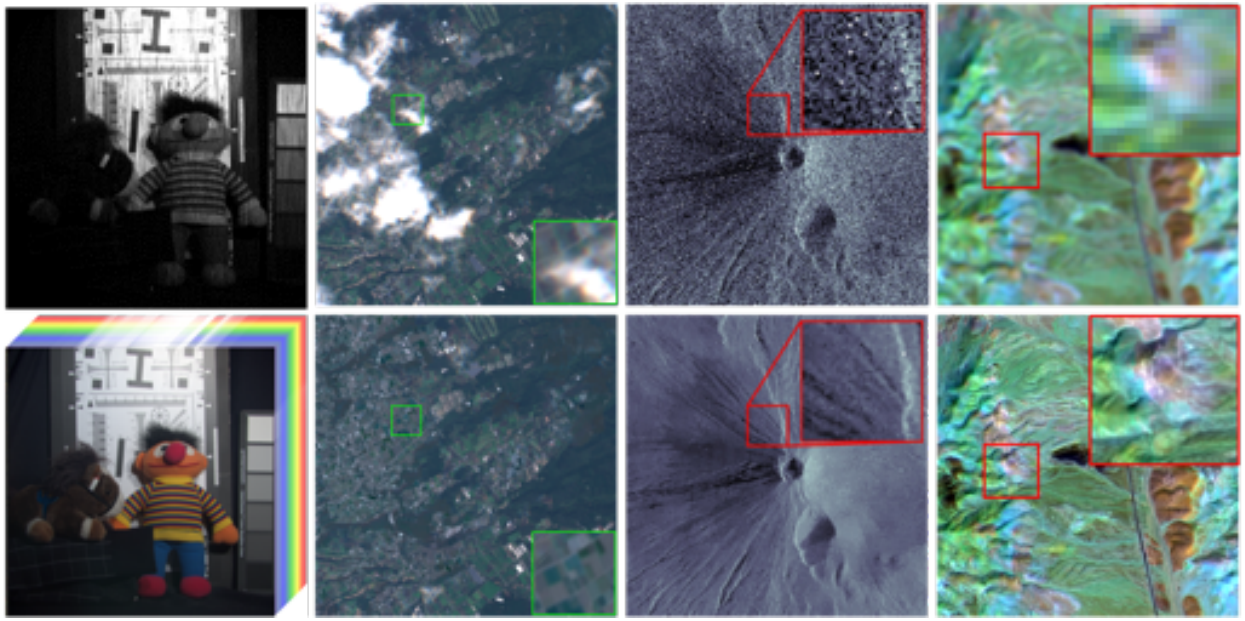






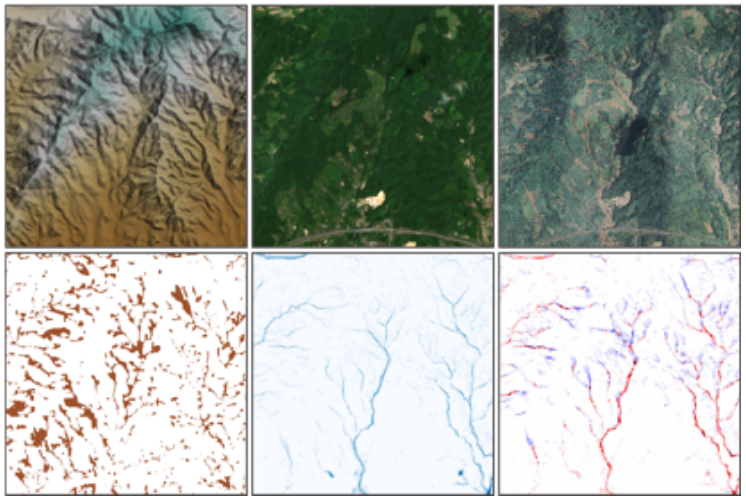
Recent Research Topics

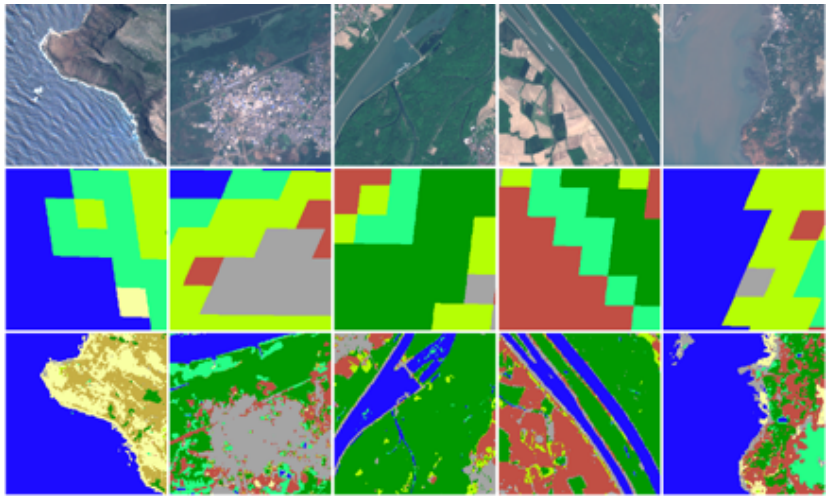
- Computational imaging
  - Recover images from incomplete measurements
  - Compressive spectral imaging, super-resolution, inpainting, image fusion, etc.
  - Deep image prior, low-rank tensor analysis, etc.



Recent Research Topics

- Remote sensing image analysis
  - Human annotation is expensive in remote sensing
  - Mapping, 3D reconstruction, and change detection with low-cost supervision
  - Label super-resolution, learning from synthetic data, cross-modal learning etc.





Sugiyama-Yokoya-Ishida Lab:
Machine Learning and Statistical Data Analysis

- Goal: Develop computers that learn like us.
  - Supervised learning: We directly help computers.
  - Unsupervised learning: We do not help computers.
  - Reinforcement learning: We indirectly help computers.
- Research aspects:
  - Theory: Probability, statistics, optimization, information theory, etc.
  - Algorithm: Effectiveness, efficiency, practicality, etc.
  - Application: signal, image, sensor, web, language, robot, biology, brain, medicine, etc.