Intelligent control

Computational intelligent techniques have been developed in signal processing and data mining, recent years they are successfully applied to the areas of automatic control, such as system identification, adaptive control, fault detections, etc. In this course, several recent computational intelligent algorithms in automatic control will be discussed. Specific topics covered include neural networks (deep learning) for control, fuzzy control, and reinforcement learning for control.

- **Neural networks for control (20 hrs)**
  1. Structure of neural network: Feedforward, Recurrent (4)
  2. Learning methods: Backpropagation, Stability (4)
  3. Modeling with neural networks (6)
  4. Control based on neural network model (6)
- **Deep learning for control (10 hrs)**
  1. Deep learning (2)
  2. Convolutional neural networks (CNN) (4)
  3. Long-short term memory (LSTM) (4)
- **Reinforcement learning (RL) for control (10 hrs)**
  1. Bellman equation, (2)
  2. Dynamic Programming, Monte Carlo Methods (2)
  3. Temporal-Difference Learning (2)
  4. Approximation (2)
  5. Optimal control with RL (2)
- **Fuzzy control (10 hrs)**
  1. Fuzzy System, Fuzzy reasoning (2)
  2. Fuzzy-neuro systems, ANFIS (4)
  3. Neuro-fuzzy control (4)
- **GAN (4 hrs)**

References

[1] Simon Haykin, *Neural Networks: A Comprehensive Foundation*, Prentice Hall, 2nd Edition, 1998. *Neural Networks and Learning Machines*, 3rd Edition, Person, 2016

[2] Li-Xin Wang, *A Course in Fuzzy Systems and Control*, Prentice Hall, Upper Saddle River, NJ, 1997

[3] R.S. Sutton, A.G. Barto, *Reinforcement Learning: An Introductio*n, 2nd edition, The MIT Press, 2018

[4] L.Busoniu, R.Babuska, Bart.Schutter, D.Ernst, *Reinforcement Learning and Dynamic Programming Using Function Approximators Technology*, CRC Press, 2010