

NUSCE Handout

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WELCOME!

This is NUSCE (NUS Computational Economics) study group

Introduction

Computation plays a crucial role both in industry and academic research. In my opinion, a standard workflow usually follows these key steps:

1. propose a question
 2. model it utilizing mathematical and statistical tools
 3. come up with parameter calibration or estimation strategy
 4. design algorithms
 5. coding-level implementation and deployment
- The first step requires domain knowledge, e.g. economics, finance
 - Math, optimization and statistics are needed in the second and third steps
 - CS skills and knowledge (at least useful senses) are indispensable for the efficient execution (step 4, 5), especially in large scale, real-time and high frequency cases

Our targets

NUSCE is committed to performing a “good” computation. To achieve a “good” computation, knowledge in statistics, math, optimization and skills in CS are required, thus NUSCE will cover them!

After NUSCE, we expect we can

- learn and understand math/stat/Opt theories by doing computation
- familiarize ourselves with the widely used numerical methods
- efficiently conduct the large scale computation using use R, Python (C++)
- solve ad hoc problems ourselves

Topics

Part I. Computer Sciences

1. Computer Structure
2. Operating System
3. Concurrent Programming
4. Distributed System (MapReduce)
5. Algorithm Theoretical Analysis
6. An Introduction to Quantum Computing

Note: R language will be the main programming tool in NUSCE, C++ and Python will be employed for demonstration and comparison purpose

Part II.

1. Linear Equations and Iterative Methods
2. Optimization
3. Nonlinear Equations
4. Approximation Methods
5. Numerical Integration and Differentiation
6. (Quasi-) Monte Carlo and Simulation Methods
7. Finite-Difference Methods
8. Projection Methods for Functional Equations
9. Numerical Dynamic Programming
10. Regular Perturbations of Simple and Multidimensional System
11. Advanced Asymptotic Methods
12. Solution Methods for Perfect Foresight and Rational Expectations Models

Reference: Judd, K. L., & Judd, K. L. (1998). Numerical methods in economics. MIT press.

Part III.

Invite guest speakers for the topics below:

- Computation in tech firms (Google, FaceBook, etc)
- Computation in top hedge funds (Citadel, D. E. Shaw, etc.)
- Fog Computation and IoT (Top IoT firm from Silicon Valley)
- To be added

Organizational form

1. Online (Zoom)
2. TC (Theory + Code demo)
3. 2 hours, biweekly
4. Each member should present one topic in Part II (send the note 3 days ahead, simply borrow from reference book when drafting)
5. Timeslot: TBC

Hopefully, we can achieve industry-level expertise after the training in NUSCE. Knowing and leveraging the technology advances helps bridge the gap between our research and industry!

Email to gangg@u.nus.edu with title [NUSCE_your name] if you are interested in NUSCE (you will be added to the mail list)