

Statistics and Numerical Methods, Tsinghua University

Introduction

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Institute for Advanced Study (IASTU) & Department of Astronomy (DoA)



清華大學

Tsinghua University

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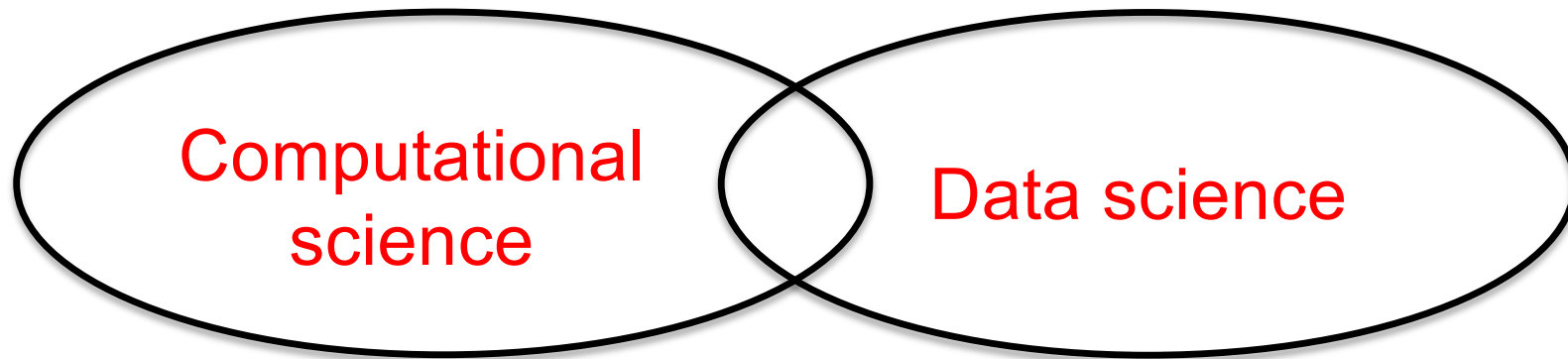
Supercomputing in China



National supercomputing centers in Tianjin, Guangzhou, Wuxi, Chengdu, Ji'nan, Changsha, Zhengzhou, Kunshan, etc.

No longer join the Top500 list. Fastest machines use domestically produced CPUs, and would have ranked the top. (Need users!)

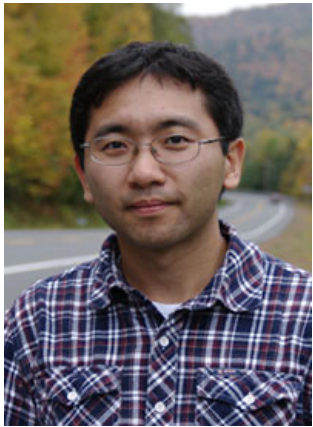
Scope



Main components:

- **Algorithm**: methods for (efficiently) solving equations and/or analyzing data.
We focus on algorithms, emphasizing the basic ideas behind, but less on math details.
- **Software**: computer implementation of the algorithms.
We only briefly discuss implementation. You will implement some algorithms, as well as using matured software.

Instructors



Xuening Bai (白雪宁)

Professor, Institute of Advanced Study

Adjunct professor, Department of Astronomy

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Office hour: Tuesdays 1:30-3pm, by email appointment



Dandan Xu (许丹丹)

Associate professor, Department of Astronomy

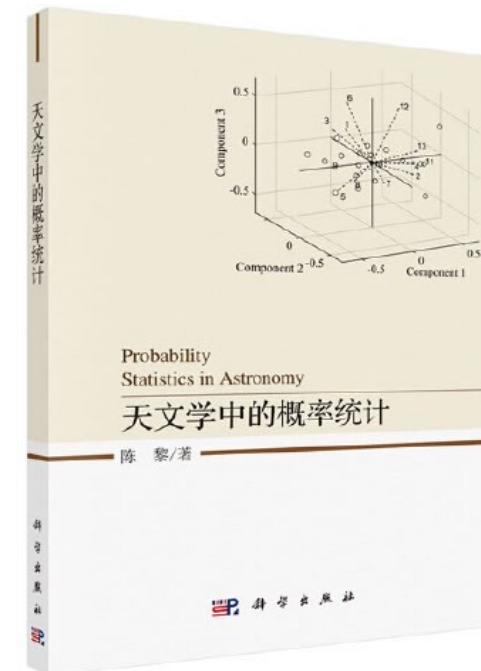
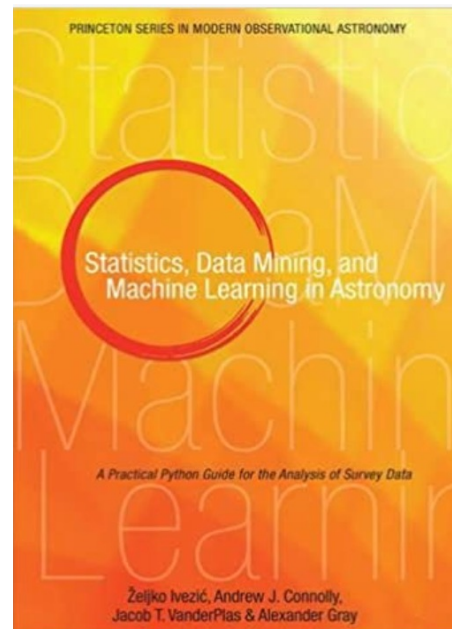
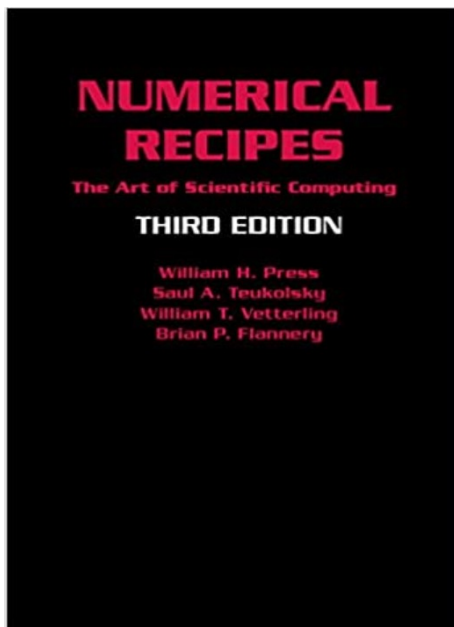
Office: Physics Building E221

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Office hour: Tuesdays 1:30-3pm, by email appointment

Textbooks and references

The course material is developed from a variety of sources. There is **no required textbook**, but several books below are recommended for further reading, and some others will be mentioned in specific lectures.



See syllabus for more details.

Problem sets

There will be **six problem sets** assigned throughout the semester. They will be posted after the lecture, and are **due two weeks later**.

You should **submit the homework through the web learning platform**. Please pack them using **.zip format**, with the following **naming convention**:

2024310000_ZhangSan_HW2.zip

Grade with comments will be returned in 2 weeks.

A penalty of 10% lower grade per day will be incurred for late submission, except for special reasons.

*Some problems can be challenging: **don't start at the last moment!***

Discussion/consultation with your peers are permitted, but the answers submitted must be the results of your own efforts.

Course schedule

Dates	Content	Lecturer	Comments
9/10	Introduction; basic scientific computing	XB	
9/17	No lecture		
9/24	Interpolation/differentiation/integration	XB	
9/29	Numerical linear algebra I	XB	HW1
10/8	Numerical linear algebra II, Nonlinear systems	Zhuo Chen	
10/15	Optimization methods	XB	HW1 due; HW2
10/22	Ordinary differential equations	XB	
10/29	Partial differential equations	XB	HW2 due; HW3
11/5	Probability and statistical distributions	XB	
11/12	Classical statistical inference	XB	HW3 due; HW4
11/19	Bayesian statistical inference	DX	
11/23*	Monte Carlo method and Stochastic processes	DX	HW4 due; HW5
12/3	Model Regression	DX	
12/10	Fourier analysis and Application	DX	HW5 due; HW6
12/17	Data Structure and Classification	DX	
12/24	Applications	TBD	HW6 due

Dandan traveling;
Time/location TBD.

Course materials are dense, but you should find them very useful!