CS515

Matrix Computations

Fall 2025
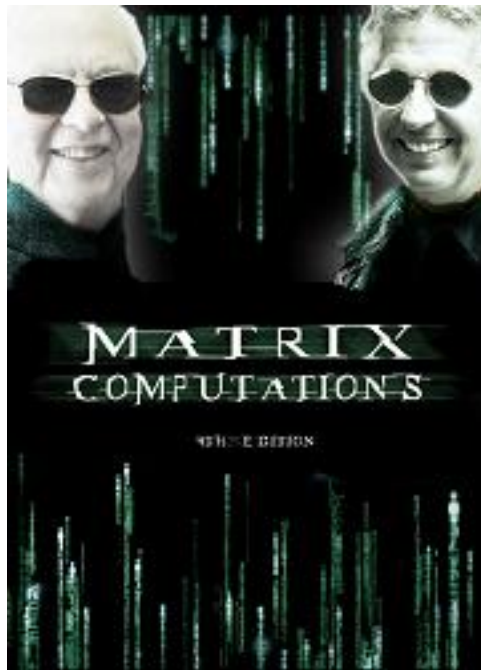
Destination	Airline	Time	Status	
...nlands	...ERICA	9:41 PM		
The Island of Myst	UT☺PIAir	9:13 PM		
The Matrix	GOSSAMERICA	5:29 PM	On Tim...	
The Metaverse	UntitledAirlines	10:02 PM	On Time	
The Night Kitchen	DYST☺PIAir	8:41 PM	On Time	
The Stillness	IncorpoREAL	6:32 PM	On Time	
Themyscira	WISTFUL	6:56 PM	On...	
Tlön	IncorpoREAL	6:21 PM	On Time	
Toad Hall	☺DDYSSEY	8:24 PM	On Time	∞
Tralfamadore	Airudite	10:12 PM	Canceled	∞
Trantor	JANEAIR	6:18 PM	On Time	∞
Treasure Island	IncorpoREAL	8:27 PM	On Time	∞
Trisolaris	QUANTUM	6:42 PM	On Time	∞
Trude	☺DDYSSEY	5:11 PM	On Time	∞
Truffula Valley	IncorpoREAL	11:40 PM	On Time	∞
	...Linguist	5:04 PM	On Time	∞
	...ISTFUL	5:01 PM	On Time	∞
		11:43 PM	On Time	∞

Flipped classroom this year.

- Course Intro Video Online.

- "Why take this class & what you will learn."

Today

- What does a flipped classroom mean for you?

- Look over the syllabus and website, make sure you know what the class will look like and how you'll be evaluated.

- (If time) Help you install/get started with Julia.

What does a flipped classroom mean for you?

- Lectures are prerecorded material you can watch at your leisure!

- Then we can use class time as Q&A time for the things that people need help with.

- Although not all students do well in this format.

- So, if that's you, then please come to class and watch them on your laptop (with headphones)

- This worked last year, but if I think it isn't working, I'll revise this year.

All videos and notes posted online. I'll send out emails each class period with notes about the video, etc.

To make sure you are on-board, I'm going to collect a little survey during the first week to figure out how people are planning to navigate the flipped classroom.

Why make this flipped?

There is a wide variety of material here. Some of which is easy to understand and some of which is tough. This varies for all of you! So I think this is a better way to have access to the material.

I also want to type up more notes associated with the class. The current notes are not complete. Rather than prep the same lecture *again,* I will use this time to improve the notes.

Why make this flipped?

We have participation questions in each lecture.

I love the questions I get from you folks!

Sometimes I even get stumped.

This is a challenging class.

Homeworks will involve both theory and programming.

The exams are very challenging.

Every year, people say they spend a lot of time on it relative to other classes.

People also say it's very rewarding and they really learn the material

Matrix Computations in 2025

Isn't it all just AI now?

Quantum Algorithms

- Built on unitary / orthogonal matrices

- Work with $2^n \times 2^n$ matrices in $O(n)$ time

Matrix Computations in AI

- Use matrix structure to speedup training

- In attention $\text{softmax}(\boldsymbol{QK}^T)\boldsymbol{V} = \text{softmax}(\boldsymbol{A})\boldsymbol{V}$