Mathematics for AI

Lecture 1a

Introduction and Logistics

Mathematics for Artificial Intelligence

- Graduate Course
- 3 credits, 32 sessions
- Saturday, Wednesday, 15:30-17:30
- Instructor: Behrooz Nasihatkan
- Email: nasihatkon@kntu.ac.ir
- Office: Room 402

Exam Dates

- Midterm Exam: Thursday, 17 Aban, 9:00-12:00
- Final Exam: look at the schedule

Ask Questions

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Special Needs

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Eating in class

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How to get help

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How to give feedback?

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Anonymous form: https://goo.gl/zPxBAS

Join the Telegram channel

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https://t.me/math4AI_4021

My Telegram Channel

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t.me/behrooznasihatkon

What is considered cheating?

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- Homework

Why this course?

-

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Why this course?

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Why this course?

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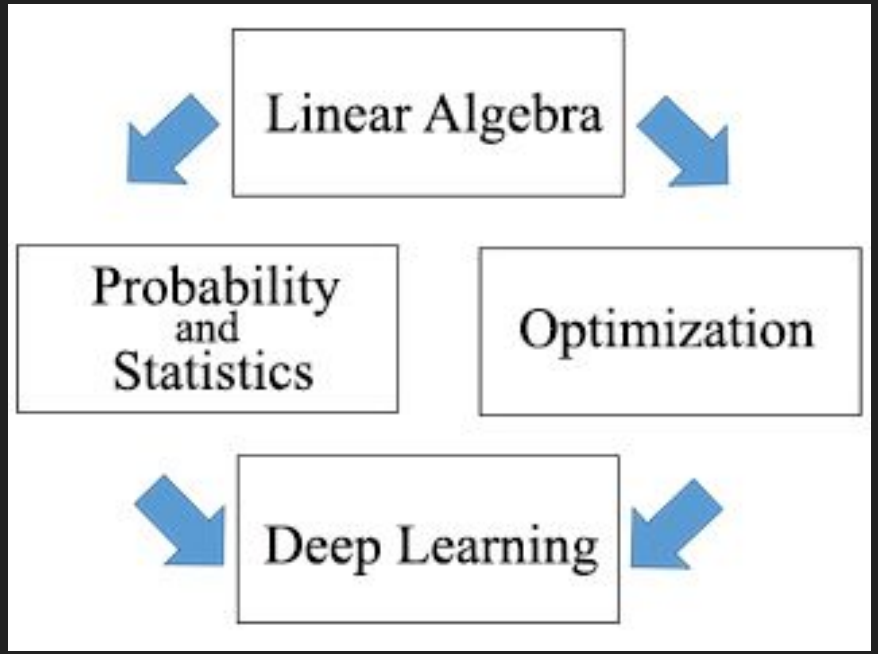

https://ocw.mit.edu/courses/18-065-matrix-methods-in-data-analysis-signal-processing-and-machine-learning-spring-2018/

Evaluation

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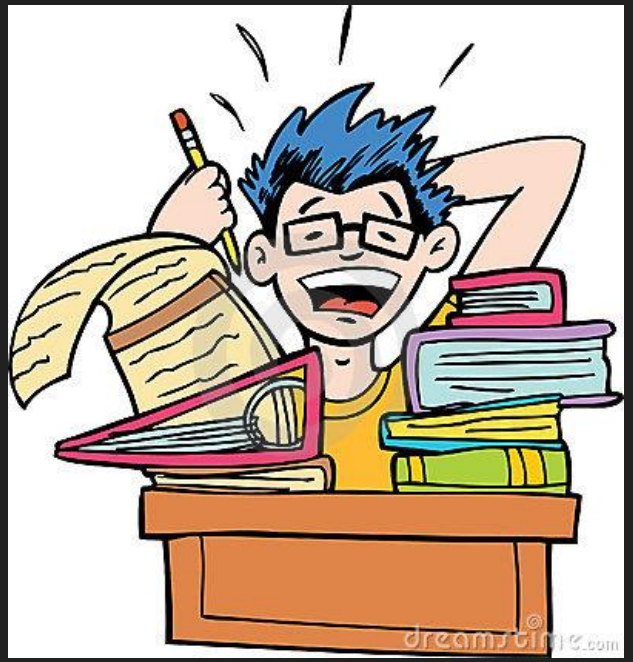
- Lab Sessions
- Homework
- Projects
- Midterm Exam
- Final Exam



Programming Languages

- Matlab
- C++
- **Python**
- R
- Julia
- ...

Homework/Projects

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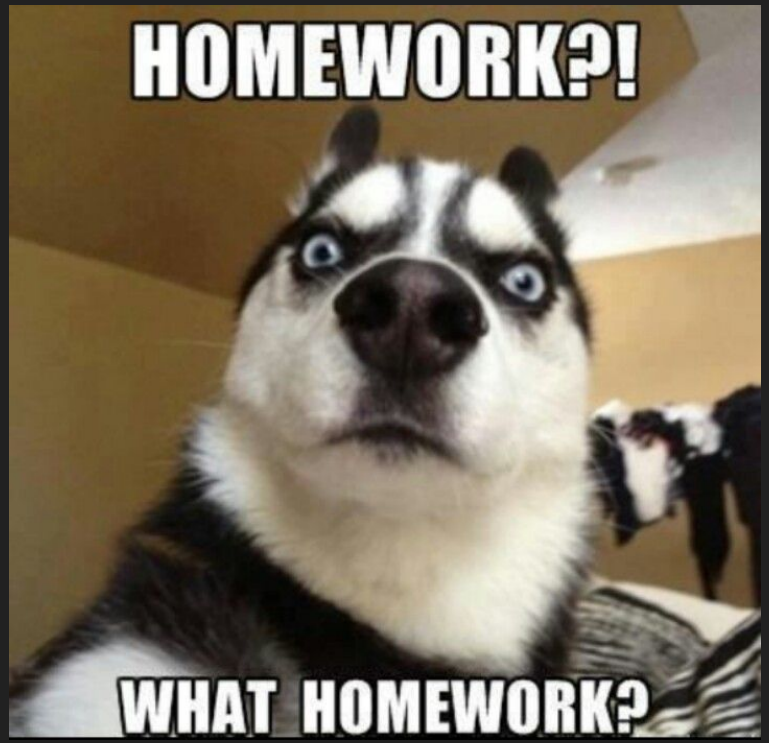
- 

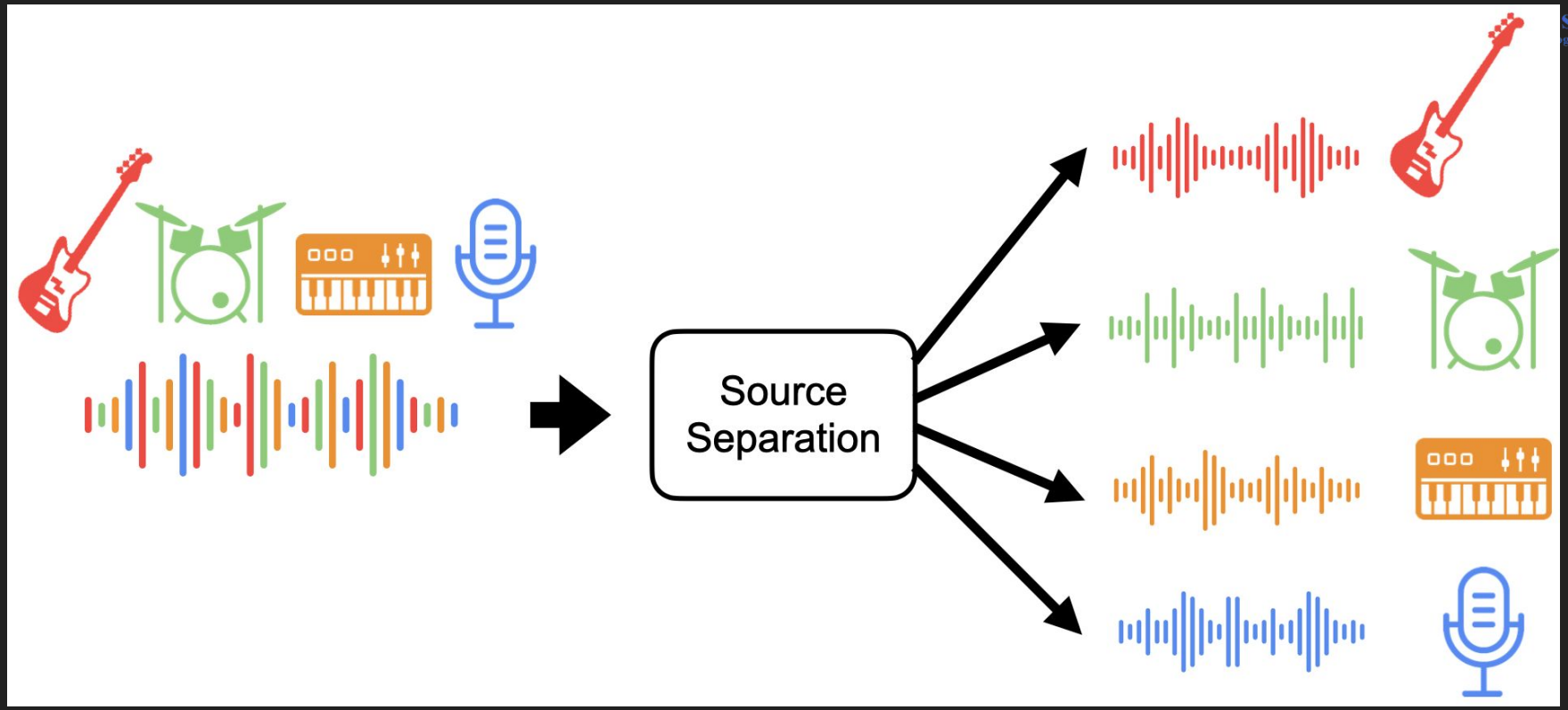
Labs

Linear Algebra Libraries

- BLAS implementations (OpenBLAS, BLIS, Intel MKL, cuBLAS)
- Lacpack
- Eigen
- Python/Numpy (numpy.linalg, scipy.linalg)
- TensorX

- Look:
  - https://en.wikipedia.org/wiki/List_of_numerical_libraries
  - https://en.wikipedia.org/wiki/Comparison_of_linear_algebra_libraries

Example: Source Separation



https://source-separation.github.io/tutorial/landing.html

Source Separation

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https://youtu.be/n7y2rLAnd5I

Source Separation

https://www.youtube.com/watch?v=tkkm6zVUDXo

Example: Source Separation

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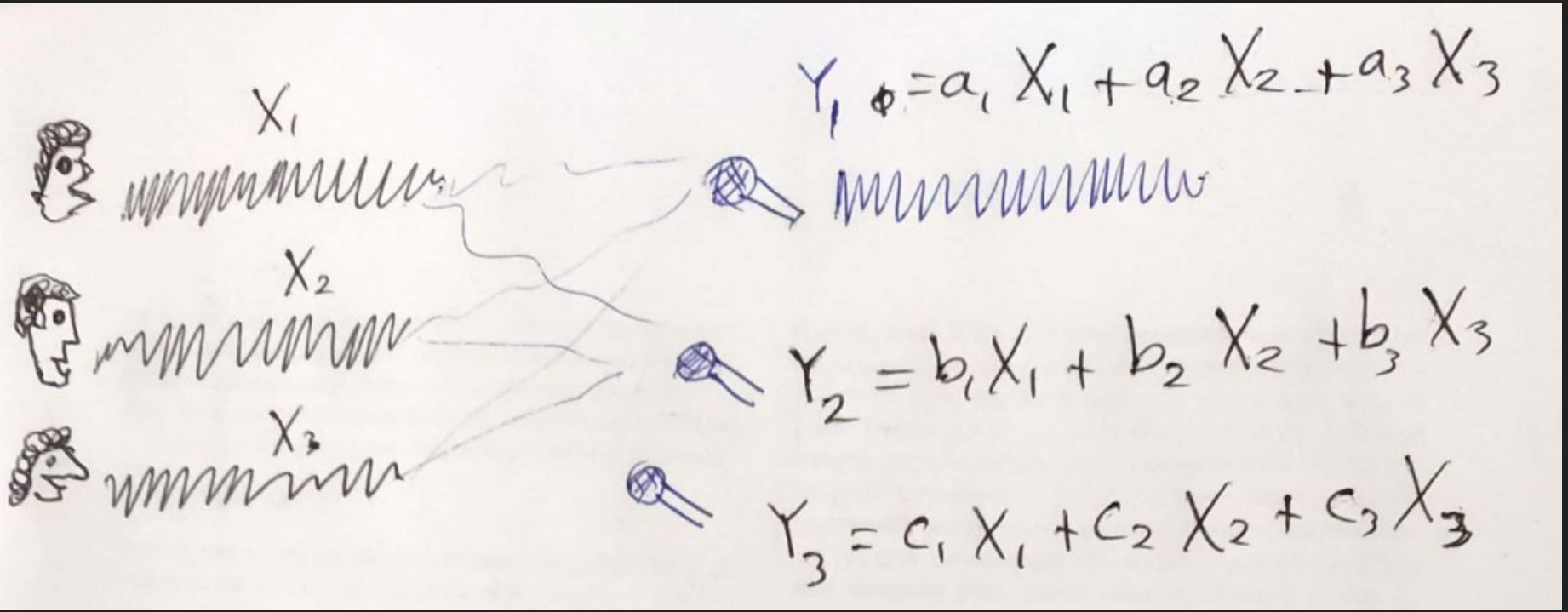

Example: Source Separation

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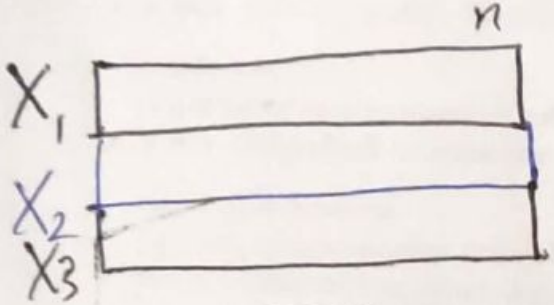
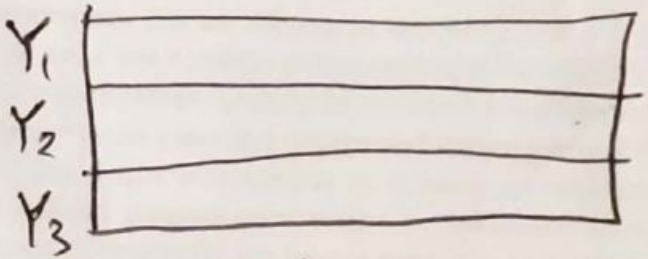


$$X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \in \mathbb{R}^{3 \times n}$$



$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} \in \mathbb{R}^{3 \times n}$$

Example: Source Separation

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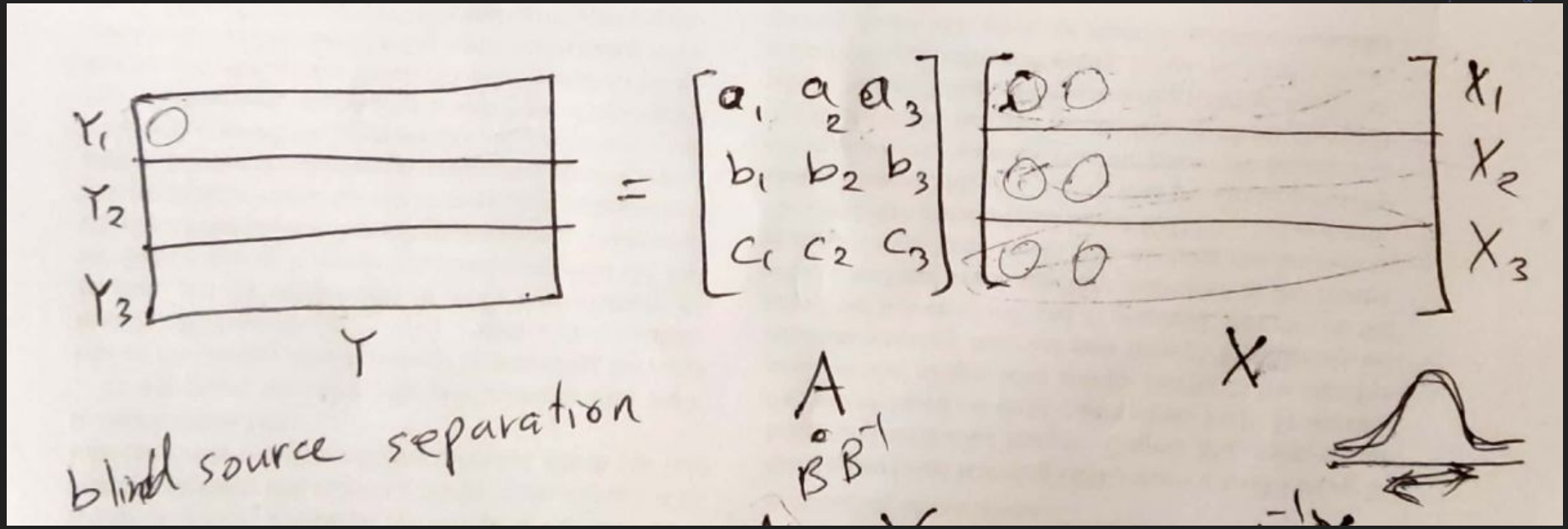

Example: Source Separation

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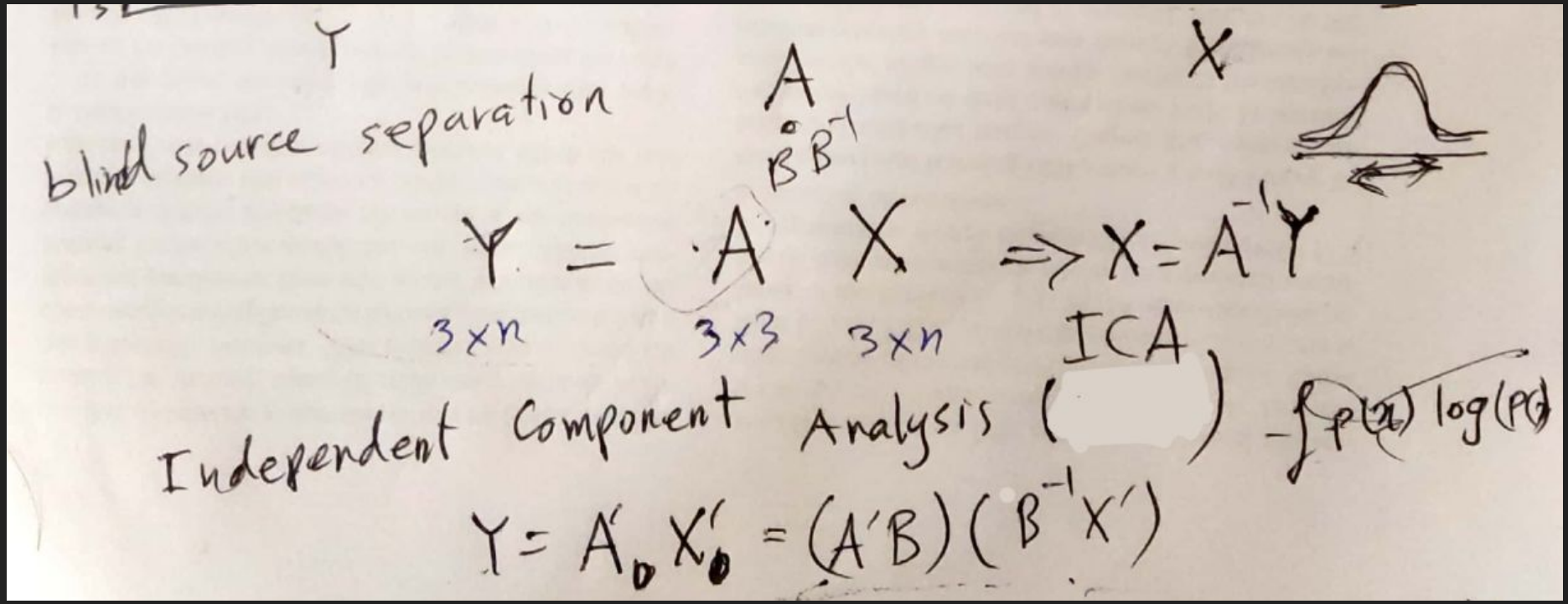

Example: Source Separation

- Linear Algebra:

$$Y = A\,X \quad \Rightarrow X = A^{-1}\,Y$$

- Probability and Statistics:

$$\text{Entropy} = -\int p(x)\log(p(x))\,dx$$

- Optimization

$$\min_{A,X} \text{Entropy}(X) \quad \text{subject to} \quad Y = A\,X$$