

Matrices, Transformations & Eigenstructure

Mathematics Foundations — Session 2

Etienne Chassaing

Today's Goal

- See a matrix not just as a grid of numbers, but as something that acts on space
 - Multiply matrices by hand and trace a vector through the forward pass of a small network
 - Read eigenvectors as the directions a transformation leaves pointing the same way, with PCA as the ML use case
- Deliverable: a by-hand two-layer forward pass, plus the max-variance eigen-direction on Iris

Plan

1. Opening Quiz
2. Matrix Multiplication
3. Matrices as Transformations
4. The Forward Pass
5. Eigenvalues & Eigenvectors
6. Exercises
7. Recap
8. To Do for Next Session

Opening Quiz

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Opening Quiz: Vectors & the Dot Product

Matrix Multiplication

1. Opening Quiz
- 2. Matrix Multiplication**
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Matrix–Vector and Matrix–Matrix Multiplication

Matrices as Transformations

1. Opening Quiz
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- 3. Matrices as Transformations**
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A Matrix as a Linear Transformation

The Forward Pass

1. Opening Quiz
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The Forward Pass

Eigenvalues & Eigenvectors

1. Opening Quiz
2. Matrix Multiplication
3. Matrices as Transformations
4. The Forward Pass
- 5. Eigenvalues & Eigenvectors**
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Eigenvalues and Eigenvectors

Deliverable

A by-hand two-layer forward pass, plus naming the eigen-direction of maximum variance on a small dataset (Iris).

Exercises

1. Opening Quiz
2. Matrix Multiplication
3. Matrices as Transformations
4. The Forward Pass
5. Eigenvalues & Eigenvectors
- 6. Exercises**
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Exercises

Recap

1. Opening Quiz
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Recap

To Do for Next Session

1. Opening Quiz
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To Do for Next Session
