Matrix Group

Presentation Assignment

Presenter: Antika
Date: November 27, 2025
Duration: 30 minutes

Presentation Instructions

- The presentation contains 20 points. It is divided into three parts. The content contains 12 marks, whereas the presentation and the question answer contain 6 marks.
- The time limit is strict. You may take at most 5 minutes extra. So, in any case, try to wrap up your talk by 35 minutes.

Presentation Topic

Some matrix decompositions

The main aim of this presentation will be to study some of the matrix decompositions. For example, the polar decomposition and Singular Value Decomposition

Problem

1. **Polar Decomposition:** Let $U(n, \mathbb{K})$ denotes the set of all $n \times n$ unitary matrices and $\mathrm{Pd}(n, \mathbb{K})$ denotes the set of all $n \times n$ positive definite matrices. Show that the multiplication map

$$\mu : U(n, \mathbb{K}) \times \mathrm{Pd}(n, \mathbb{K}) \to GL(n, \mathbb{K}), \quad (U, P) \mapsto U \cdot P$$

is a homeomorphism. In particular, each invertible matrix A can be written in a unique way as a product $A = U \cdot P$ of a unitary matrix U and a positive definite matrix P.

2. **Singular Value Decomposition**

Good luck with your presentation! If you have any questions, please don't hesitate to reach out.