4.0 Module Overview: The Four Fundamental Spaces

Module Overview

In this module we will talk about the four fundamental spaces of a matrix and how they connect geometrically. You will learn, in addition to the column space and null-space, to calculate the row space and the left-null-space of a matrix.

The important notions of independence, basis and dimension of a vector space will be introduced. You will learn to calculate them for all four fundamental spaces of a matrix.

In addition, you will learn to identify orthogonal and complementary orthogonal subspaces.

Finally, the highly useful notion of projection will be introduced. You will learn to project vectors to vector spaces.

Module Outcomes

As a result of this module, you will be able to do the following:

1. **Identify** independent sets of vectors and spanning sets of vector spaces
2. **Compute** bases and dimensions for the four fundamental spaces.
3. **Compute** projections of vectors to subspaces.

Assigned Reading

- Chapter 3: Sections 3.5, 3.6
- Chapter 4: Sections 4.1, 4.2

Module Outline

In this module, we will cover the following:

+ A. Lecture Videos

+ B. Live Session

+ C. Assessments