



Module PMRF-ISSS058/II/2025

Equivariant Neural Networks

Name of the PMRF student

Pavan Subhaschandra Karjol

Required background of the students taught

Basics of group theory

Details of the content of the module

Module 1 – Introduction to symmetry and group theory. Definitions and examples of groups and their actions. Subgroups, cosets, quotient groups, representations, and equivariant maps.

Module 2 – Translation equivariance in CNNs. Permutation invariance in Deep Sets. Graph neural networks and symmetry in graph structures.

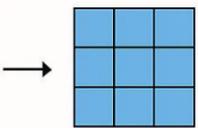
Module 3 – Group-equivariant CNNs and steerable filters. Equivariance under rotations and reflections. Lie groups, Lie algebras, and continuous symmetries.

Module 4 – Applications in vision, physics, and molecules. Equivariant networks on manifolds. Learning symmetries from data and recent research directions.

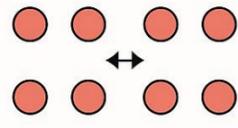
Module 5 – Tensor field networks, spherical CNNs, gauge equivariant nets, and transformers. Equivariant flows, normalizing flows, and generative models.

EQUIVARIANT NEURAL NETWORKS

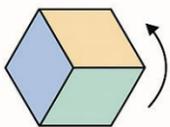
Translation



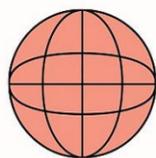
Permutation



Rotation and Reflection



Lie Groups



Schedule of the module

Start Date: Jun 25, 2025

Details of the content of the module

Live lectures will be conducted (or recorded lectures uploaded) on Wednesdays and Fridays from 11:30 AM to 1:00 PM (25 Lectures)

End Date: Tentatively by Nov 5, 2025

Total lecture hours : 50 (approx.)

Meeting link : Will be shared later

[Link](#)

Contact email ID: pavankarjol@iisc.ac.in

Registration link:

<https://forms.gle/DQvYNSbfpdvdL7yT8>