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DS 4002

# Case Study Rubric — Reconstructing Turbulence Fields Using CAEs

## Purpose of This Case Study

This case study is designed to teach you how Convolutional Autoencoders can be applied to real scientific data. You will learn how to prepare a dataset, train a CAE, generate reconstruction visuals, and communicate your findings. Your deliverables should demonstrate understanding, clarity, and professional presentation.

## Student Tasks

You are responsible for completing the following:

1. Load and explore the provided turbulence dataset.
2. Train a Convolutional Autoencoder (CAE) using the provided starter notebook.
3. Generate reconstruction visuals comparing original vs. reconstructed samples.
4. Write a brief interpretation (3–6 sentences) explaining:
  - a. What patterns the CAE captures well
  - b. Where reconstruction errors occur
  - c. Why the model behaves this way
5. Organize your results in a clean, professional format.

## Deliverables

### 1. Reconstruction Visuals (Required)

- At least two figures showing original vs. reconstructed turbulence samples
- Must be clear, labeled, and easy to interpret

## **2. Written Interpretation (Required)**

- 1 paragraph (3–6 sentences)
- Professional tone
- Clearly discusses strengths and limitations of the CAE

## **3. Notebook or Script Output (Required)**

- A functioning notebook showing your workflow
- Must run start-to-finish with minimal modification

# **Criteria for Success**

## **Technical Execution — 40 points**

- CAE trains successfully without errors
- Reconstruction visuals are generated correctly
- Student uses the provided scripts appropriately

## **Interpretation & Insight — 30 points**

- Interpretation demonstrates understanding of CAEs
- Explains both strengths and limitations of reconstruction
- Connects results to model behavior

## **Organization & Professionalism — 20 points**

- Deliverables are clean, labeled, and easy to follow
- Notebook is readable and well structured
- Visuals are formatted clearly

## **Following Instructions — 10 points**

- All required components submitted
- Repository organization is maintained

## **Total: 100 Points**

Late or incomplete submissions may receive partial credit at the instructor's discretion.