**MODULE 4: Weeks 7-14: From Theory to Practice: AI in Immunological Cases**

**Overview**: In this module, students will transition from theoretical knowledge to hands-on application of AI and machine learning techniques in immunology. Using the PITCH dataset, students will explore how AI can be used to predict immunological memory to emerging viruses. Each group will be assigned specific tasks involving different machine learning approaches, and they will work collaboratively to analyze the data, interpret the results, and present their findings.

**Week 7: Tuesday, 10/15/2024**

**Title: *SIMON says: Advancing Human Immunology using AI***

**Activities**:

* Lecture by Dr. Tomic:
  + Introduction to AI applications in immunology.
  + Provide an overview of the tools (SIMON and PANDORA) used in the practical course.

**Week 7: Thursday, 10/17/2024**

**Title: *Laying the Groundwork: Preparation for AI-Driven Immunology***

**Activities**:

* Self-Paced Work:
  + Video-guided installation of PANDORA software.
  + Reading and discussion of the SIMON publication to understand the theoretical background.

**Week 8: Tuesday, 10/22/2024**

**Title: *Predicting Immunological Memory to Newly Emerging Viruses: Practical Introduction***

**Activities**:

* Lecture by Dr. Tomic:
  + Explanation of the PITCH study and its significance in immunology research.
  + Overview of the practical tasks assigned to each group, including the specific machine learning approaches they will employ.
  + Detailed instructions for the upcoming hands-on sessions.

**Weeks 8-10: Thursday, 10/24/2024 - Thursday, 11/7/2024**

**Title: *Hands-On Practical Sessions: Applying AI in Immunology***

Activities:

* Hands-On Work:
  + Each group works collaboratively on their specific task, applying the assigned machine learning approach (e.g., PCA, tSNE, hClust, Correlation).
  + Groups 1-4 (unsupervised ML) exchange information
  + Groups 5-6 (supervised ML\_ exchange information
  + Groups prepare the theoretical background and methodology for their presentations.
  + Continuous instructor support and guidance as groups progress with their analyses.

**Weeks 11-13: Tuesday, 11/12/2024 - Tuesday, 12/3/2024**

**Title: *Group Presentations: Unsupervised Machine Learning and SIMON Analyses***

**Activities**:

* Group Presentations:
  + Week 11:
    - *Tuesday, 11/12/2024:* Group 1 presents on PCA.
    - *Thursday, 11/14/2024:* Group 2 presents on tSNE.
  + Week 12:
    - *Tuesday, 11/19/2024:* Group 3 presents on Correlation analysis.
    - *Thursday, 11/21/2024:* Group 4 presents on Naïve Bayes.
  + Week 13:
    - *Tuesday, 11/26/2024:* Group 5 presents on Deep learning.
    - *Tuesday, 12/3/2024:* Group 6 presents on SIMON autoML.

**Week 14: Thursday, 12/5/2024**

**Title: *NextGen Immunology: Final Discussion and Wrap-Up***

**Activities:**

* Discussion Session:
  + Wrap-up discussion to consolidate what was learned throughout the module.
  + Encourage students to share insights and discuss how they might apply what they've learned in future research or professional work.