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| **MODULE 8: Deploying EO-based ML Models** | |
| **OBJECTIVES** | * Understand the concept of taking a trained and validated model beyond the academic cradle - and into a real world environment * Are aware of various considerations and concepts involved with deployment (e.g. re-training, designing with the user in mind) * Gain familiarity with tools and platforms for deployment * Understand how to deploy a trained model to share with users |
| **METHODS** | Lectures, demos, code-alongs, application exercises, and structured discussion |
| **DURATION** | 8 hours for participants |

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| # | SESSION | DURATION | LEARNING OBJECTIVES |
| 8.1 | Taking ML models into prototyping and production environments | 2 hour | * Understand the concept of taking a trained and validated model beyond the academic cradle - and into a real world environment * Be aware of various considerations and concepts involved with deployment (e.g. re-training, designing with the user in mind) |
| 8.2 | Deployment frameworks and platforms for rapid deployment | 6 hours | * Be familiar with various established deployment frameworks and PaaS platforms for deployment (e.g. Heroku, Streamlit, Anvil, GCP Vertex AI etc) including strengths and weaknesses of each * Complete an exercise in deploying a trained model using one of these frameworks |

**OVERVIEW OF EXERCISES**

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| **#** | **Exercise Name** | **Alignment with Learning Objectives** |
| 8.1 | Deploying Models to Production | * Gain familiarity with tools and platforms for deployment * Understand how to deploy a simple trained model or prototyping purposes |

**8.1** **Taking ML models into prototyping and production environments**

**8.1 Quiz questions**

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| 1. Which of the following is NOT a reason for deploying ML models? | 1. Application Integration 2. User Feedback and Iteration 3. Real-world Testing 4. Increased complexity of the model |
| 2. Prototyping deployments typically deal with \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | 1. Large-scale data and multiple simultaneous users 2. Small-scale data and users, often in a controlled or simplified environment 3. Robust and reliable ML models handling a variety of inputs and conditions 4. Rigorous testing before deployment, including unit tests, integration tests, stress tests |
| 3. Which of the following is NOT part of the monitoring process? | 1. Performance Metrics 2. Logging and Alerting 3. Drift Monitoring 4. Model Tuning |
| 4. In a production environment, which of the following 2 elements are most required? | 1. Large-scale data and multiple simultaneous users 2. Small-scale data and users, often in a controlled or simplified environment 3. Development of robust and reliable ML models handling a variety of inputs and conditions 4. Rigorous testing before deployment, including unit tests, integration tests, stress tests |
| 5. What does "data drift" refer to? | 1. A change in the ML model's distribution over time 2. A change in the input data's distribution over time 3. A breakdown in the relationship between the explanatory and response data used to train a model 4. A complete overhaul of the model's architecture and design |
| 6. Which aspect of the model could potentially increase the financial costs of the required IT infrastructure? | 1. The use of smaller datasets for training the model 2. The use of smaller or less complex models 3. The use of larger or more complex models which can be more computationally intensive 4. The decrease in user volumes and requests per user |

**8.1 Resources:**

* Article: <https://paulvanderlaken.com/2020/03/24/ml-model-performance-degradation-production-concept-drift/>
* Article: <https://towardsdatascience.com/dont-let-your-model-s-quality-drift-away-53d2f7899c09>

**8.2** **Taking ML models into prototyping and production environments**

No Quiz

**8.2 Resources:**

* Video: [Heroku Explained Icebergs, Lumberjacks, and Condos](https://youtu.be/VrhW9NXfKmg)
* Article: <https://analyticsindiamag.com/hands-on-guide-to-machine-learning-model-deployment-using-flask/>