**MACHINE LEARNING IN PYTHON FOR ENVIRONMENTAL SCIENCE PROBLEMS SHORT COURSE**

**SHORT COURSE ORGANIZERS**
David John Gagne, National Center for Atmospheric Research, Boulder, Colorado
Sheri Mickelson, National Center for Atmospheric Research, Boulder, Colorado
Greg Herman, Climate Corporation, Seattle, Washington
Ryan Lagerquist, University of Oklahoma, Norman, Oklahoma

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**8:30 A.M.** **ARRIVAL AND INTRODUCTIONS.** David John Gagne

**8:45 A.M.** **DATA ANALYSIS AND PRE-PROCESSING.** Sheri Mickelson

- Introduction to short course data and problem.
- Reading meteorological data files with xarray and pandas.
- Exploratory visualization with matplotlib.
- Data transformations.
- Separating into training and test sets.

**10:00 A.M.** **COFFEE BREAK.**

**10:30 A.M.** **SUPERVISED MACHINE LEARNING WITH SCIKIT-LEARN.** Greg Herman

- What is supervised learning?
- Introduction to scikit-learn.
- Linear regression models.
- Decision trees.
- Random forests.

**11:45 A.M.** **SHORT COURSE LUNCHEON (INCLUDED).**

**12:45 A.M.** **DEEP LEARNING WITH KERAS.** David John Gagne

- What is deep learning?
- Introduction to keras.
- Artificial neural networks.
- Convolutional neural networks.

**2:00 P.M.** **COFFEE BREAK.**

**2:30 P.M.** **INTERPRETATION OF MACHINE LEARNING MODELS.** Ryan Lagerquist

- Overview of model interpretation.
- Variable importance (*e.g.,* using the permutation method).
- Saliency maps.
- Feature visualization by optimization ("backwards optimization").
- Novelty detection.

**3:45 P.M.** **ADJOURN.**