

The U.S. Army Test and Evaluation Command Educational Partnership Cadre is pleased to share the second article in the Massive Open Online Courses series. This article focuses on resources for employees involved with Operational Tests or Soldier Touch Points and Data Analysis to include Visualization. Ms. Casey Turner, Chief of the Advanced Analytics and Initiatives Division in the Army Evaluation Center (AEC), and a cadre member, shares free self-paced Coursera courses to expand knowledge in Artificial Intelligence (AI), Machine Learning, Data Analysis, Data Science, R Programming Language, and Python.

Non-Technical for Focus Groups and AI:

The first two courses are non-technical and relevant to anyone involved in an Operational Test or Soldier Touch Point with Focus Groups, or anyone who is evaluating a system with an AI aspect to them.

Introduction to Focus Groups - Conduct a Focus Group

Course Link: <https://www.coursera.org/lecture/qualitative-research/introduction-to-focus-groups-YHo9t>

Offered by: University of California, Davis

Level: Intermediate

Duration: 15 hours

Why: Nearly every evaluator uses focus groups in operational test events to collect feedback from the test participants. Current focus groups methods are highly scrutinized by outside organizations like Program Managers, Director Operational Test & Evaluation, and the Institute for Defense Analyses. This relatively short course provides evaluators the understanding of how to plan and facilitate focus groups as well as analyze resulting information. Evaluators will quickly learn to recognize differences between well and poorly executed focus groups. This course is critical for AEC's effort to improve their evaluation of qualitative user feedback.

- Explain limitations and risks of qualitative research
- Create a moderator guide
- Analyze focus group data and create a focus group report following common business practices in qualitative market research

AI For Everyone

Course Link: <https://www.coursera.org/learn/ai-for-everyone>

Offered by: DeepLearning.AI

Level: Beginner

Duration: 6 hours

Why: AI will become increasingly common in Army systems in the coming years, with initial programs already entering the acquisition lifecycle. This short course gives an intuitive foundation on how AI works, what it is good at, and where it has challenges.

- Meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science
- What AI realistically can and cannot do
- Spot opportunities to apply AI to problems in your own organization
- Build machine learning and data science projects
- Work with an AI team and build an AI strategy in your company
- Navigate ethical and societal discussions surrounding AI

Excel and JMP:

The next two courses focus on Excel and JMP for data analysis and visualization in ATEC. The Excel course, targeted for beginner users, will likely have insights to benefit experienced users. For those that use Excel frequently, the JMP course will illustrate how to analyze data more efficiently and effectively.

Introduction to Data Analysis Using Excel

Course Link: <https://www.coursera.org/learn/excel-data-analysis#syllabus>

Offered by: Rice University

Level: Beginner

Duration: 20 hours

Why: Excel is the most common tool used for data analysis in ATEC. This course will show powerful tools to make the student more efficient and effective with Excel.

- Introduction to Spreadsheets
- Functions to Organize Data (IF, nested IF, VLOOKUP, and HLOOKUP)
- Filtering, Pivot Tables, and Charts
- Advanced Graphing and Charting

Statistical Thinking for Industrial Problem Solving

Course Link: <https://www.coursera.org/learn/statistical-thinking-applied-statistics>

Offered by: JMP

Level: Beginner

Duration: 44 hours

Why: In a relatively short period, this course teaches thinking about data with a statistical/analytical mindset while covering numerous JMP functions/features. An introductory course to learn JMP, with the benefit to help evaluators think more analytically.

- How to describe data with statistical summaries, and how to explore your data using advanced visualizations
- Understand statistical intervals, hypothesis tests and how to calculate sample size
- How to fit, evaluate and interpret linear and logistic regression models
- How to build predictive models and conduct a statistically designed experiment

R:

The next series of courses focuses on R programming language. A simple programming language designed to make data processing, statistics, and visualization easy. It is the preferred tool of the AEC STAT team for performing statistical analysis. The first introductory course will benefit everyone. The following three specialization courses will benefit employees ready to move beyond Excel and JMP to a more complex, and far more powerful toolset.

Calculating Descriptive Statistics in R

Course Link: <https://www.coursera.org/projects/calculating-descriptive-statistics-in-r>

Offered by: Coursera Project Network

Level: Beginner

Duration: 2 hours

Why: In just 2 hours, this guided project will help evaluators calculate descriptive statistics and data summaries in R. This course has two advantages of learning basic functions in R, and learning applicable summary statistics based on either qualitative or quantitative variables.

- Calculate basic descriptive statistics for qualitative variables
- Calculate basic descriptive statistics for quantitative variables
- Check the distribution of quantitative variables

Specializations:

A series of courses designed around a common theme are specializations. The initial courses of each specialization assume you know little to nothing about R, and build from there. It is not necessary to complete all of the courses in a specialization. Most only require a few hours per week.

Data Visualization & Dashboarding with R Specialization

Course Link: <https://www.coursera.org/specializations/jhu-data-visualization-dashboarding-with-r>

Offered by: Johns Hopkins University

Level: Beginner

Duration: 5 courses, 5 hours a week for 4 months

Level: Beginner

Why: This is an all-encompassing data visualization course that teaches powerful R tools like ggplot, and teaches evaluators the magic behind shiny apps. In addition, there is general lecture on what makes high-quality graphics. This is a relevant course for evaluators that want to produce quality data visuals.

Courses:

- Getting Started with Data Visualization in R
- Data Visualization in R with ggplot2
- Advanced Data Visualization with R
- Publishing Visualizations in R with Shiny and flexdashboard
- Data Visualization Capstone

Tidyverse Skills for Data Science in R Specialization

Course Link: <https://www.coursera.org/specializations/tidyverse-data-science-r>

Offered by: Johns Hopkins University

Duration: 5 courses, 3 hours a week for 7 months

Level: Beginner

Why: This is a wide-ranging R course that covers data management, data visualization, and data analysis using the Tidyverse family of packages. This Tidyverse package provides evaluators more than enough tools for the common evaluation; therefore, focusing R skills in the Tidyverse world is a great start for all evaluators to learn R.

Courses:

- Introduction to the Tidyverse
- Importing Data in Tidyverse
- Wrangling Data in Tidyverse
- Visualizing Data in Tidyverse
- Modeling Data in Tidyverse

Data Science Specialization

Course Link: <https://www.coursera.org/specializations/jhu-data-science>

Offered by: Johns Hopkins University

Duration: 10 courses, 7 hours a week for 11 months

Level: Intermediate

Why: This is a comprehensive specialization going through the entire lifecycle of data science, covering data management, analysis, visualization, and machine learning.

Special Note: The first five courses in this specialization comprise the “Data Science: Foundations using R Specialization”, <https://www.coursera.org/specializations/data-science-foundations-r#about>, with a duration of 8 hours a week for 5 months.

Courses:

- The Data Scientist’s Toolbox
- R Programming
- Getting and Cleaning Data
- Exploratory Data Analysis
- Reproducible Research
- Statistical inference
- Regression Models
- Practical Machine Learning

- Developing Data Products
- Data Science Capstone

Python:

One of the most popular programming languages in the world due to its versatility. Python supports a variety of applications from web development to machine learning. Equipped with a number of libraries, it enables coders to write programs for data analysis and machine learning quickly and efficiently. Python can conduct complex statistical calculations, create data visualizations, build machine learning algorithms, manipulate and analyze data, and complete other data-related tasks.

Python Basics

Course Link: <https://www.coursera.org/learn/python-basics>

Offered by: University of Michigan

Duration: 36 hours

Level: Beginner

Why: Python is a good first programming language with simple syntax. At the same time, it is one of the most commonly used languages in the areas of data processing and AI. This course provides a solid introduction to the language.

Recommended before taking the Deep Learning specialization.

AI and Machine Learning:

For those who want to know all the details about how AI works; below are recommendations for AI courses. These courses are not necessary for those evaluating systems that contain AI, but will certainly help.

Deep Learning Specialization

Course Link: <https://www.coursera.org/specializations/deep-learning>

Offered by:

Duration: 5 courses, 7 hours a week for 5 months

Level: Intermediate

Why: This course goes in great depth into how AI works, focusing on applications such as image recognition which will be increasingly common in Army systems in the coming years. Recommend taking Python Basics course before beginning this specialization.

Courses:

- Neural Networks and Deep Learning
- Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization
- Structuring Machine Learning Projects
- Convolutional Neural Networks
- Sequence Models

Reinforcement Learning Specialization

Course Link: <https://www.coursera.org/specializations/reinforcement-learning>

Offered by: University of Alberta, Machine Intelligence Institute

Duration: 4 courses, 4 hours a week for 5 months

Level: Intermediate

Why: Reinforcement learning is an AI learning technique not covered in the Deep Learning series, but is applicable to Army AI systems, especially systems trained in the field.

Courses:

- Fundamentals of Reinforcement Learning
- Sample-Based Learning Methods
- Prediction and Control with Function Approximation
- A Complete Reinforcement Learning System (Capstone)