

Time	Day 1, 8:00-11:00 AM US-EDT	Day 2, 8:00-11:00 AM US-EDT
8-8:30	<ul style="list-style-type: none"> • Welcome • DSPA Summer Course Overview (ISI/WSC, prereqs, vision, objectives, outcomes, Website) • Introductions (Instructor: Ivo Dinov; Attendees: please post in Chat/Discussion-Forum: Participant's Name, Affiliation, Title, interests, and "one fun fact about you") • Course Coverage • Expectations and optional capstone project (below) • SOCR Resources: Datasets & Case-studies, Webapps, DSPA, Spacekime/TCIU, GitHub, Prob & Stats EBook, SMHS EBook, Current SOCR Users • Open Science – <i>It's online, therefore it exists!</i> • Download DSPA Textbook (free) • Resource Search & Navigation, Language Translations 	<ul style="list-style-type: none"> • Review of Day 1 • Questions, comments, issues? • Supervised AI <ul style="list-style-type: none"> ○ Model-based <ul style="list-style-type: none"> ▪ Baseball players physique modeling ▪ k-NN prediction of galaxy spin ○ Model-free <ul style="list-style-type: none"> ▪ Estimate the square root function $\sqrt{\cdot}$ using NN ▪ NN Google Trends and the Stock Market
8:30-9	<ul style="list-style-type: none"> • Motivation – the 7D of Big Data <ul style="list-style-type: none"> ○ Digitalization of all human experiences ○ Responsible Data Science/Ethical Predictive Analytics • R vs. Python vs. SAS vs. SPSS vs. other SW • Confirm local installations of R & RStudio • RStudio GUI • Rmarkdown Notebook (IDE) – End-to-end Pipeline Workflow from raw data → models → visualization → analytics → reporting/pubs • Example Demo (requires knitr package) <ul style="list-style-type: none"> ○ Chap4 RMD Source, HTML output, SOCR Header • Math Foundations 	<ul style="list-style-type: none"> • Unsupervised AI • Classification and clustering (k-Means, spectral, hierarchical) <ul style="list-style-type: none"> ○ Hot-dogs example ○ Silhouette plots ○ Pediatric trauma clustering study
9-9:30	<ul style="list-style-type: none"> • 5-min Break • Data types – categorical & numeric, structured and unstructured, scalar, vector, matrix, data-frame, tensor, list, object • Data manipulation – import/export, EM imputation, webpage scraping, sample statistics (moments) • EDA (visualization) • Compare R EDA vs. HTML/JS: SOCRAT (NI data of AD/MCI/NC), Motion Charts (Housing Prices), BrainViewer (raw MRI, DTI tracks, Brain Atlas) 	<ul style="list-style-type: none"> • 5-min Break • Reticulation (interoperability between R, Python, C/C++ and other languages) • Text modeling & NLP (sentiment analysis example)
9:30-10	<ul style="list-style-type: none"> • Probability Distributions – Distributome, TVN Webapp • Dimensionality reduction <ul style="list-style-type: none"> ○ Linear PCA: 2D→1D example, PPMI example 	<ul style="list-style-type: none"> • Longitudinal data analysis (Google trends analytics)
10-10:30	<ul style="list-style-type: none"> • 5-min Break • Non-linear: MNIST data OCR: UMAP OCR, t-SNE OCR • SOCR/Tensorboard/Projector UKBB Brain Study 	<ul style="list-style-type: none"> • 5-min Break • Role of optimization in AI/ML (Healthcare manufacturer product optimization example) • Deep neural networks (image-classification example)
10:30-11	<ul style="list-style-type: none"> • Capstone project – interactive-learning using monthly US macro-economic data. Use the RMD source, the example HTML output, and the provided data to experiment with some of the DSPA techniques. Think of ways to <i>augment</i> these data (expand the time range and increase the feature richness) 	<ul style="list-style-type: none"> • DSPA Appendices: Bayesian Simulation, Modeling and Inference » Information-Theoretic Foundation of Statistical Learning » Surface, Shape, and Manifold Representation and Visualization » Power Analysis in Experimental Design » Database SQL/NoSQL Queries & Google BigQuery » Image Convolution, Filtering, & Fourier Transform » Causality, Transfer Entropy, & Mechanistic Effects » Agent-based Reinforcement Learning • Demonstrations of interesting Capstone project results
11-11:30	<ul style="list-style-type: none"> • Open discussion 	<ul style="list-style-type: none"> • Open discussion

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https://wiki.socr.umich.edu/index.php/SOCR_News_ISI_DSPA_Training_2022