

MULTIPARADIGM DATA SCIENCE

WITH THE POWER OF THE WOLFRAM LANGUAGE





Multiparadigm data science uses modern analytical techniques, automation and human-data interfaces to move the bar on answers. Rather than confining itself to a narrow set of traditional statistical analyses, it applies a wide range of cutting-edge algorithms and interdisciplinary computational methods to extract insights, meaning and decisions from data.

Having the right interface to get answers from data is crucial. Different interfaces are suited to different tasks—from naturallanguage queries to scheduled report generation to live modeling presentations. In some cases you want deployment as an interactive cloud document, in others as a web API.

A multiparadigm approach requires a broad, flexible computational toolkit that incorporates all aspects of a project into one start-tofinish workflow. The Wolfram technology stack does exactly this, enabling you to take data from hundreds of formats, carry out a full spectrum of analysis and visualization, and immediately share or publish your results—all using the world's largest collection of algorithms and computable knowledge. A simulation of information diffusion in a social network using density heat maps to analyze connectivity and nearness in a small-world network.





The built-in GlobalClusteringCoefficient function efficiently analyzes large datasets from SocialMediaData, using ColorData and Grid for easy visual interpretation of the results. wolfr.am/mpds-gc

Predictions of US Senate voting behavior and increasing political partisanship based on a nearest-neighbor analysis, providing computational insight into multidimensional data.





NearestNeighborGraph quickly computes proximity measures in images, text and numerical and geoposition data. wolfr.am/mpds-nn

Visualizing unstructured datasets with automatic partitioning and dimensional analysis—facilitated by high-level data semantics and unsupervised machine learning.





FindClusters automatically groups similar items for a variety of data types, imported using SemanticImport and immediately visualized using ListPlot. wolfr.am/mpds-fc

Visually tracking the progress and performance of dataset training in a neural network with interactive status monitors and automated background computations.





TrainingProgressReporting and TrainingProgressFunction provide several methods for the monitoring of neural network training. wolfr.am/mpds-tp

High-level computer vision automatically examines and tracks visual features using prebuilt machine learning models, with advanced options for exploring specific parameters.





Manually examine points of interest in images using ImageKeypoints, or instantly identify objects in images with ImageIdentify. wolfr.am/mpds-ii

Automatic categorization of built-in images using advanced feature extraction and dimension reduction, displayed using a variety of plot and graph visualizations.





FeatureSpacePlot and ClusteringTree construct hierarchical visualizations from extracted features of all kinds of datasets, including data from the Wolfram Knowledgebase. wolfr.am/mpds-fp

Predicting the next move in rock-paper-scissors or the next word in a sentence with builtin predictors and linguistic data, with advanced options for tweaking performance.

 $\mathsf{sp} = \mathsf{SequencePredict}[\{\{ \&, \bigcirc \}, \{ \bigcirc, \bigcirc, \bigcirc \}, \{ \bigcirc, \bigcirc, \& \}, \{ \bigcirc, \bigcirc \}, \{ \bigcirc, \bigcirc \} \}]$ SequencePredictorFunction sp[{€, , , Probabilities"] $\langle \left| \bigcirc \right\rangle \rightarrow 0.422177, \swarrow \rightarrow 0.370295, \bigcirc \rightarrow 0.207528 \left| \right\rangle$





SequencePredict uses automatically selected algorithms to infer sequences from a variety of data types, with linguistic support in seven languages and cross-platform compatibility for hundreds of data formats. wolfr.am/mpds-sp

Analyzing the changes of mood throughout the complete text of *A Tale of Two Cities* using automated text processing and pre-trained classifiers on a curated data resource.



The Period It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulty, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had nothing before us, we mere all going direct to Heaven, we were all going direct the other way— in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.	Positive
There were a king with a large jaw and a queen with a plain face, on the throne of England; there were a king with a large jaw and a queen with a fair face, on the throne of France.	Neutral
In both countries it was clearer than crystal to the lords of the State preserves of loaves and fishes, that things in general were settled for ever.	Neutral
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I see the blots I threw upon it, faded away.	Negative
I see him, fore-most of just judges and honoured men, bringing a boy of my name, with a forehead that I know and golden hair, to this place—then fair to look upon, with not a trace of this day's disfigurement—and I hear him tell the child my story, with a tender and a faltering voice.	Negative
"It is a far, far better thing that I do, than I have ever done; it is a far, far better rest that I go to than I have ever known."	Negative



Classify uses machine learning to determine contextual sentiment values of a ResourceObject imported from the Wolfram Data Repository and parsed using TextSentences. wolfr.am/mpds-sa

A community analysis graph of a Reddit AMA shows connections among machinelearned clusters of related questions, using textual data imported through a curated service connection.





FindGraphCommunities and CommunityGraphPlot use performance-optimized machine learning algorithms to analyze and display clusters in data retrieved with ServiceConnect. wolfr.am/mpds-cg

A financial dashboard displays multiple visualization types from live financial data for rapid analysis of key indicators and predictive models.





FinancialData provides historic financial information for immediate visualization with ListPlot and AngularGauge, using Manipulate for interactive controls. wolfr.am/mpds-db

Immediate geovisualization of Runkeeper statistics from IoT data automatically accumulated and processed in the cloud.





Collect and parse GeoPosition data with the Wolfram Data Drop, import as a TimeSeries and generate a map with GeoGraphics. wolfr.am/mpds-gp

Modeling and predicting the spread of an outbreak with a suite of visualizations, seamlessly combining public health data with computable geographic data.





SemanticImport parses incoming data, combining it with built-in geographic entities and tuning visualizations with options such as GeoBackground, GeoProjection and GeoRange. wolfr.am/mpds-si

Displaying maps and locations of summer meal sites by ZIP Code through a public web form to help students in need.





Import **ResourceData** for direct use in a **GeoListPlot** visualization, and deploy it to the web as an interactive **FormPage** using **CloudDeploy**. **wolfr.am/mpds-rd**

A multidimensional dataset is parametrized using a neural network with custom layers, reducing it to a scalar manifold for intuitive analysis and visualization.





NetChain, NetGraph and NetTrain reduce dimensions using a MeanSquaredLossLayer, with the result visualized using StreamPlot and ListPlot. wolfr.am/mpds-dr

Sophisticated time series functions automatically select from built-in fitting methods for highly accurate forecasting, with options for creating and fitting new classes of hybrid models.





Use **TemporalData** and **TimeSeriesModelFit** to create autoregressive, moving-average and seasonal models in a few lines of code. **wolfr.am/mpds-tt**

Test for variances between populations and differences in proportion with statistical visualizations, automatically fitting your data to any combination of over 150 built-in distributions.





DistributionFitTest checks for various fits using symbolic distributions, guiding selection of the appropriate test distribution for your data. wolfr.am/mpds-tm

The Wolfram Language provides the most complete implementation of multiparadigm data science. Browse nearly 6,000 functions to see the full space of data science computations.

Core Language & Structure	Data Manipulation & Analysis		Visualization & Graphics	
Machine Learning	Symbolic & Numeric Computation		Strings & Text	Wc hg ^{pd}
Graphs & Networks	Images		Geometry	
Sound	Knowledge Representation & Natural Language		Time-Related Computation	
Geographic Data & Computation	Scientific and Medical Data & Computation		Engineering Data & Computation	
Financial Data & Computation	Social, Cultural & Linguistic Data		Higher Mathematical Computation	
Notebook Documents & Presentation	User Interface Construction	++++++++++++++++++++++++++++++++++++++	System Operation & Setup	N
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