

# Data Science Survey

Section I: PURPOSE & OUTCOMES

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Section V: ANALYSIS TECHNIQUES

## I. PURPOSE & OUTCOMES

For questions Q1-Q6, please rate your experience on a scale of 0–4, where:

- 0: have no knowledge or experience
- 1: aware user; limited practical experience
- 2: basic user; some past performance (clients, tasks, prior personal projects)
- 3: skilled user; significant past performance (clients, tasks, prior personal projects)
- 4: power user; expert knowledge; significant past performance

Q1-Q6: Please rate your experience with performing:

Data Science Concepts	0	1	2	3	4
Q1: <i>Exploratory data analysis</i> - the practice of analyzing data sets to summarize their main characteristics, including use of statistical and visual methods, for preliminary data discoveries.					
Q2: <i>Diagnostic data analysis</i> - the practice of looking at past performance to determine what happened and why.					
Q3: <i>Predictive data analysis</i> - the practice of using many techniques from data mining, statistics, modeling, machine learning, and artificial intelligence to analyze current data to make predictions about future events.					
Q4: <i>Time series analysis</i> - the practice of analyzing time series data to extract meaningful statistics and other characteristics of the data.					
Q5: <i>Longitudinal data analysis</i> - the practice of deriving insights from longitudinal data that captures changes in individual entities over time.					

Q6: <i>Data analysis insights as inputs to another analysis</i> - for example, using insights into key variables to inform the development of simulation models.					
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## II. TECHNOLOGY, TOOLS & PLATFORMS

For questions Q7-Q19, please rate your experience on a scale of 0–4, where:

- 0: have no knowledge or experience*
- 1: aware user; limited practical experience*
- 2: basic user; some past performance (clients, tasks, prior personal projects)*
- 3: skilled user; significant past performance (clients, tasks, prior personal projects)*
- 4: power user; expert knowledge; significant past performance*

Q7: Please rate your experience with the following programming languages:

Technology, Tools, & Platforms	0	1	2	3	4
C					
C++					
C#					
Java					
JavaScript					
Julia					
Lisp/Clojure					
.NET					
Perl					
PHP					

Python					
R					
Ruby/Rails					
Scala					
SQL					
Visual Basic					
(Free Text) <b>Other languages</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q8:** Please rate your experience with the following categories for database management systems:

Technology, Tools, & Platforms	0	1	2	3	4
Desktop relational databases (e.g., <i>MS Access</i> )					
Client-server relational databases (e.g. <i>MS SQL Server, Oracle,</i> <i>MySQL</i> )					

Non-Relational / NoSQL databases  <i>(e.g. Apache Cassandra, HBase, Bigtable/MapReduce, DataStax, Dynamo, MarkLogic, MongoDB, Redis)</i>					
Distributed databases  <i>(e.g. blockchain)</i>					
(Free Text) <b>Other languages</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q9:** Please rate your experience with data reshaping and analysis tools:

Technology, Tools, & Platforms	0	1	2	3	4
Open-source  <i>(e.g. Python—for example pandas, R—for example dplyr)</i>					
(Free Text) <b>Other open-source</b> data reshaping and analysis tools you are skilled in (Rating Level 2 or higher), separated by commas.					

Proprietary <i>(e.g. MATLAB, SAS, SPSS, Stata, Tableau)</i>					
(Free Text) <b>Other proprietary</b> data reshaping and analysis tools you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q10:** Please rate your experience with machine learning tools:

Technology, Tools, & Platforms	0	1	2	3	4
Open-source <i>(e.g. Python – for example scikit-learn, Java – for example WEKA, R – for example caret)</i>					
(Free Text) <b>Other open-source</b> machine learning tools you are skilled in (Rating Level 2 or higher), separated by commas.					
Proprietary <i>(e.g. Amazon Machine Learning, Mathematica, MATLAB, Splunk)</i>					

(Free Text) <b>Other proprietary</b> machine learning tools you are skilled in (Rating Level 2 or higher), separated by commas.	
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**Q11:** Please rate your experience with network analysis tools:

Technology, Tools, & Platforms	0	1	2	3	4
Open-source  <i>(e.g. Gephi, pajek, Python – for example networkx, Java – for example JUNG, R – for example sna)</i>					
(Free Text) <b>Other open-source</b> network analysis tools you are skilled in (Rating Level 2 or higher), separated by commas.					
Proprietary  <i>(e.g. ORA, UCINET)</i>					
(Free Text) <b>Other proprietary</b> network analysis tools you are skilled in (Rating Level 2 or higher), separated by commas.					

Q12: Please rate your experience with using the following:

Technology, Tools, & Platforms	0	1	2	3	4
Deep Learning frameworks (e.g. <i>Caffe</i> , <i>TensorFlow</i> , <i>Theano</i> , <i>Torch</i> ).					
(Free Text) <b>Other deep learning</b> tools you are skilled in (Rating Level 2 or higher), separated by commas.					

Q13: Please rate your experience with using the following:

Technology, Tools, & Platforms	0	1	2	3	4
Source code management and control tools (e.g. <i>Git</i> , <i>Mercurial</i> , <i>Subversion</i> (SVN))					
(Free Text) <b>Other source code management and control tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					



Q14: Please rate your experience with the following:

Technology, Tools, & Platforms	0	1	2	3	4
Generating data visualizations (e.g. <i>Chart.js</i> , <i>D3.js</i> , <i>Gephi</i> , <i>Processing</i> , <i>Tableau</i> ).					
(Free Text) <b>Other data visualization tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

Q15: Please rate your experience with the following:

Technology, Tools, & Platforms	0	1	2	3	4
Generating data dashboards (e.g., <i>MicroStrategy</i> , <i>MS Excel</i> , <i>Tableau</i> , <i>Qlik</i> ).					
(Free Text) <b>Other data dashboard tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

Q16: Please rate your experience with the following:

Technology, Tools, & Platforms	0	1	2	3	4
Tools for distributed computing					

(e.g., Flink, Hive/Impala, Pig, Spark, Storm, Vertica).					
(Free Text) <b>Other distributed computing tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q17:** Please rate your experience with the following:

Technology, Tools, & Platforms	0	1	2	3	4
Cloud-based resources for big-data computing  (e.g. Amazon AWS, Cloudera, Google Cloud, IBM Bluemix/SoftLayer, Microsoft Azure, Oracle Cloud, Salesforce).					
(Free Text) <b>Other distributed computing tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q18:** Please rate your experience with geographical information system (GIS) tools:

Technology, Tools, & Platforms	0	1	2	3	4
Open-source GIS tools  (e.g. GRASS GIS, QGIS, uDig)					

(Free Text) <b>Other open-source GIS tools</b> you are skilled in (Rating Level 2 or higher)					
Proprietary GIS tools  (e.g. <i>Esri products such as ArcGIS</i> )					
(Free Text) <b>Other proprietary GIS tools</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q19:** Please rate your experience with leveraging the following technologies for enabling more efficient data analytics:

Technology, Tools, & Platforms	0	1	2	3	4
GPU processing					
In-memory processing					
Microservices					
Multi-threading					

### III. DATA SIZE

For questions Q20-Q22, please rate your experience on a scale of 0–4, where:

*0: have no knowledge or experience*

*1: aware user; limited practical experience*

*2: basic user; some past performance (clients, tasks, prior personal projects)*

*3: skilled user; significant past performance (clients, tasks, prior personal projects)*

*4: power user; expert knowledge; significant past performance*

Q20: Please rate your experience in using the following data set sizes for analysis:

Data Size	0	1	2	3	4
Less than 10GB					
More than 10GB, up to 100GB					
More than 100GB, up to 1TB					
More than 1TB, up to 100TB					
More than 100TB, up to 1PB					
More than 1PB					

Q21-Q22: Please rate your experience with performing the following:

Data Size	0	1	2	3	4
Q21: <i>Feature selection</i> - the process of <i>selecting</i> a subset of <i>relevant features</i> (variables, predictors) for use in model construction. Feature selection returns a subset of the features.					

<p><b>Q22: <i>Feature extraction</i></b> – the process of <i>transforming</i> data in the high-dimensional space to a space of fewer dimensions. Feature extraction creates <i>new features</i> from functions of the original features.</p> <p>(e.g. <i>principal component analysis (PCA)</i>, <i>multiple correspondence analysis (MCA)</i>).</p>					
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#### IV: DATA CHARACTERISTICS, STORAGE & MANAGEMENT

For questions Q23-Q26, please rate your experience on a scale of 0–4, where:

- 0: have no knowledge or experience*
- 1: aware user; limited practical experience*
- 2: basic user; some past performance (clients, tasks, prior personal projects)*
- 3: skilled user; significant past performance (clients, tasks, prior personal projects)*
- 4: power user; expert knowledge; significant past performance*

**Q23:** Please rate your experience with processing and handling the following data formats:

Data Characteristics, Storage, & Management – Data Characteristics	0	1	2	3	4
Audio formats					
Geospatial formats (e.g. <i>Esri</i> , <i>GeoJSON</i> , <i>GML</i> , <i>LandXML</i> )					
Hierarchical Data Format (HDF)					
Image formats					

JavaScript Object Notation (JSON)					
Tabular CSV/ASCII					
Video formats					
XML					
Unstructured text					
(Free Text) <b>Other data formats</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

Q24-Q25: Please rate your experience with the following:

Data Characteristics, Storage, & Management – Data Storage	0	1	2	3	4
<p><b>Q24: Data warehouses</b> - central repositories of integrated data from one or more disparate sources, but the data (as opposed to data lakes) is <i>predominantly structured and processed</i>.</p> <p>In other words, before data may be loaded into a data warehouse, it first needs some shape and structure (also known as <i>schema-on-write</i>). The end users are typically professionals interested in business intelligence insights.</p>					

<p><b>Q25: Data lakes</b> - storage repositories that hold a vast amount of <i>raw data in its native format</i>. As opposed to data warehouses, data lakes may include structured, semi-structured, and unstructured data, as well as formats like video and audio.</p> <p>Increasingly, the term is being accepted as a way to describe any large data pool in which the schema and data requirements are not defined until the data is queried. In other words, with a data lake, you load in the raw data, as-is; when it is needed, you give it shape and structure (also known as <i>schema-on-read</i>). The end users are typically data science professionals.</p>					
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**Q26:** Please rate your experience with the following:

Data Characteristics, Storage, Management – Data Management	0	1	2	3	4
<p><b>Q26:</b> Developing policies for <b>data governance</b> - the practice of managing the availability, usability, integrity, ownership, stewardship, and security of the data employed in an enterprise.</p>					

## V. ANALYSIS TECHNIQUES

For questions Q27-Q34, please rate your experience on a scale of 0–4, where:

- 0: have no knowledge or experience*
- 1: aware user; limited practical experience*
- 2: basic user; some past performance (clients, tasks, prior personal projects)*
- 3: skilled user; significant past performance (clients, tasks, prior personal projects)*
- 4: power user; expert knowledge; significant past performance*

Q27-Q28: Please rate your experience with performing the following:

Analysis Techniques – Data Engineering and Processing	0	1	2	3	4
Q27: <b>Data engineering</b> (includes what some companies might call <b>data infrastructure</b> or <b>data architecture</b> ) - Data engineering involves gathering and collecting the data, storing the data, running batch processing or real-time processing on the data, and serving the data via an API to data scientists who can easily query it.					
Q28: <b>Extract, Transform, Load (ETL)</b> - a data integration process for transferring raw data from a source server to a data warehouse on a target server and then preparing the information for downstream use.					

Q29-31: Please rate your experience with performing the following:

Analysis Techniques – Data Science	0	1	2	3	4
Q29: <b>Feature engineering</b> - practice of transforming raw data into features that better represent the underlying problem to the predictive models, resulting in improved model accuracy on data not explicit in the set.					



<b>Q30: Supervised feature learning</b> – a process in which features are learned with labeled input data  <i>(e.g. supervised neural networks, multilayer perceptron, and (supervised) dictionary learning).</i>					
<b>Q31: Unsupervised feature learning</b> – a process in which features are learned with unlabeled input data  <i>(e.g. dictionary learning, independent component analysis, auto-encoders, matrix factorization, and various forms of clustering such as k-means).</i>					

**Q32:** Please rate your experience with performing the following machine learning techniques and algorithms:

Analysis Techniques – Data Science	0	1	2	3	4
Convolutional Neural Network (CNN)					
Decision Tree					
Deep Learning					
Deep Neural Network					
K-means Clustering					
Support Vector Machine (SVM)					
Text Mining/Natural Language Processing (NLP)					
(Free Text) <b>Other machine learning techniques and algorithms</b> you are skilled in (Rating Level 2 or higher), separated by commas.					

**Q33:** Please rate your experience with the following simulation modeling methods:

Analysis Techniques – Simulation Modeling	0	1	2	3	4
Agent-based					
Discrete-event					
Microsimulation					
Monte Carlo					
Systems dynamics					

**Q34:** Please rate your experience with the following:

Analysis Techniques – Simulation Modeling	0	1	2	3	4
<b>Q34:</b> Using simulation modeling (e.g. <i>agent-based modeling</i> , <i>Monte Carlo</i> ) to <b>generate pseudo-data sets</b> for study in scenarios where no real-world data exists.					

END SURVEY