

# پک پیشرفته متخصص دیتاساینس

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سرفصل‌های دوره آموزشی

# Neural Networks & Deep Learning

## Machine Learning and types of learning

- Supervised
- Unsupervised
- Semi-supervised
- Self-supervised
- Reinforcement Learning

## Supervised Learning

- Classification
- Regression

## Evaluation of Supervised Learning

- Confusion Matrix, Accuracy
- Precision
- Recall
- F-measure
- Bias-Variance trade off
- Overfitting

## Neural Networks

- Neurons
- Layers
- Weights
- Activation Functions (Sigmoid, Hyperbolic tangent, ReLU and ...)

## Training of Neural Networks

- Loss Function
- Backpropagation Algorithm

## Data Preparation

- Normalization and Standardization
- Data Transformation (One-hot encoding)

## TensorFlow and Keras

- Implementation of Neural Networks
- Data Preprocessing and Loading in TF

## Hyperparameter Tuning

- Epoc
- Batch Size
- Optimizer
- Learning Rate

## Computer Vision and Convolutional Neural Networks

- Implementation of Convolutional Neural Networks in TensorFlow
- Transfer Learning, Data Augmentation
- Classification and Localization
- Semantic Segmentation
- Instance Segmentation

## Dropout, Early Stopping, Batch Normalization and Regularization

## Sequence processing and Recurrent Neural Networks

- LSTM
- GRU
- NLP & Embeddings
- Sentiment Analysis
- Machine Translation
- Attention mechanism
- Transformer
- Auto encoders

**Reinforcement Learning**

**Graph Neural Networks**

**Generative Adversarial Networks**

**Large Language Models**

# Bash Scripting

**Note:** In this course, you will learn each topic with code samples, practical use cases, and exercises.

## Getting started with Bash Scripting

- The what and why of scripting with Bash
- What is Bash Scripting?
- Basic script building
- The Shebang!
- Bash Script name format
- Setting up permission on shell scripts
- Execute a script
- Variables and Scopes
- Special parameters
- Importance of quoting, spaces and escaping in bash scripts
- Double quote vs Single quote
- Exit codes
- Exiting an script
- Bash configuration files
- Shells and Subshells
- Random variable usage and control
- Debugging the bash script

- Creating interactive bash scripts
- Bash script controls
- Shell comments
- Documentation
- Command source and period (.)
- Scripts on system startup
- Getting and setting dates and delays

## **Functional Framework**

- Alias and functions
- Functions with arguments
- Writing and calling functions
- Function return values
- Local variables
- Make aliases and functions permanent

## **Navigating to directories and Listing**

- Wildcards
- Pattern matching and regular expression
- Copy, rename, delete and sorting operations
- Log control and IO redirections
- Special characters

## **Text Processing and Filters in your Scripts**

- Head and tail
- The cut command
- The paste command
- The diff command

- The comm command
- The od Command
- The join command
- The uniq command
- The tr command
- The awk command
- The nawk command
- The sed command
- The xargs command
- The tee command

## Expressions and Arithmetic

- Assignment operators
- Logical operators
- Logical NOT (!)
- Logical AND (&&)
- Logical OR (||)
- Math with the shell
- Arithmetic operators
- Math using bc
- Using bc in bash scripts
- Scale variable in bc
- Math using bash capabilities like `$[ ]` and `(( ))`
- Expr

## Using Structured Commands

- Conditional execution of command lists
- Test commands (strings, integers and file types ...)
- If statement



- If ... else statement
- Iterations
- Nesting ifs
- The for loop
- Advanced for loops
- Nesting loops
- While loop
- Until loop
- Loop over a range, List and the content of a file
- Internal Field Separator (IFS)
- More than one ...
- Testing the loops
- Redirecting loop output
- Exiting the loop with break and Continue
- Using variables and files in loops
- True, False and:
- The Case statement

## **Files Operation & Navigating Directories**

- Reading files and directories
- Basename and dirname
- Execution
- File Pat
- Listing and sorting
- Splitting
- Transfer

## Using Sort

- Sort command and output
- Sort & Uniq
- Numeric sort
- Sort by keys

## Strings

- Use regex on a string
- Uppercase & Lowercase
- Manage strings Delimiter
- Tips on string handling

## Handling Script Inputs

- Positional variables
- Variables referrals
- Controlling null variables
- Reading input from files
- Special cases
- \$\*, @\$ and \$#
- Controlling the visibility of entered text
- Passing parameters to functions
- Returning values from functions

## Work with files containing information records

- Fixed-length records
- Variable-length records
- Record processing
- Record-related operations
- Operations related to fixed-length records
- Operations related to variable-length records
- Merging operations

## Finding files based on properties

- Concepts of file access levels
- Dealing with file sizes
- Filtering searches
- Other notable considerations

## Jobs, processes and parallel processing in bash

- Pipes
- Redirections
- Background processes
- Signals and job controls
- Advanced IO redirection
- Substitutions
- Wait and parallel processing

## Arrays

- Arrays assignments
- Accessing the array elements
- Array Iteration
- Array modification
- All array operations
- Sorted arrays

## Monitoring processes and applications

- Monitor for starting a process
- Monitor for ending a process
- Monitor start and end of processes and log events
- Recording execution times of processes
- Common applications of monitoring
- Waiting for a program to terminate
- System load monitoring using uptime, sar, iostat, vmstat and ...

## Menus

- Using functions in menus
- Creating operator menus
- Give back our client a menu

## Notification of events automatically

- Automate emailing
- Automate emailing with attachment
- Mail vs mailx
- The uuencode package
- Ftp, Rsync and ... automation
- Remote Connection
- Passwordless connections

## File Transfer automation

- Merging concepts
- Using FTP to retrieve server machine files
- Downloading files from the server
- Updating server files
- nlist
- Configuring SSH
- Reading passwords in scripts

## Scheduling jobs to run in the future

- Using cron
- Using anacron
- Using at
- Controlling User access to schedulers

## Debugging

- Syntax checking
- Shell tracking
- Log tracking
- Using the set command

## Tricks with Shell Scripting

## Security with Shell Scripting

### Real-World Bash Script Training Course Scenarios:

- Generate Data Integrity Reports
- Compare Data Integrity Reports
- Unique and Duplicates Controller
- Random Digit Generator
- Files Special Filters
- Automated Interactive Input
- Parallel Executions for Time Saving
- Rotate Function
- Get and Sort play
- Get and Sort Play with Arrays
- Backup and Integrity check
- Ftp Client Automation
- User Lock and Unlock from Scratch
- Elapsed Time in Special Format
- Chkconfig Emulator (Report Generator in Fixed Length)
- High-Low Game
- Automated Pinging for Availability Check
- Multi-Platform Ping for Each OS
- Disk Space Check
- Service Control - Web Server as Sample
- Rotating Old Files
- Test Variables

- All Path Executables Files Reporter
- Id (id Command Emulation)
- Custom UserAdd Script
- File Systems and Disk Space Monitoring
- UID and GID Checker
- Data Manipulation with Fixed Offset

# ELK Stack

## Introduction to Elastic Stack

- What is the Elastic Stack? Overview and History
- Working with data, structured vs. semi-structured vs. unstructured data
- Overview of the data analysis process
- What is Big Data? Characteristics (3Vs: Volume, Velocity, Variety)
- Elastic Stack vs. ELK Stack, Evolution and Components
- Common Use Cases: Log Management, Business Analysis, Security Analytics, Monitoring
- Installing Elastic Stack Components: Elasticsearch, Logstash, Kibana, Beats

## Deep Dive into Elasticsearch

- Elasticsearch Architecture: Nodes, Clusters, and Indexes
- What is API and advanced usage of API in Elasticsearch
- Data Modeling and Indexing
- Understanding Mapping, Documents, and Fields
- CRUD Operations: Create, Read, Update and Delete data
- Search Queries: Term, Match, Range, Aggregations
- Advanced Search and Filtering: Bool Queries, Nested, and Geo Queries
- Performance Tuning with Sharding, Replication, Caching, and Index Management



## Data Collection with Logstash

- Introduction to Logstash, architecture and Pipeline Concepts
- Configuring input plugins for various data sources
- Reading data from different sources (logs, metrics, CSVs, Databases, etc.)
- Input Plugins: File, Syslog, Beats, JDBC
- Data Transformation using filters for parsing, enriching, and transforming data
- Output Plugins: Elasticsearch, File, Email, Kafka
- Managing and Debugging Pipelines
- Logstash Configuration Best Practices

## Data Visualization with Kibana

- Introduction to Kibana, Interface and Navigation
- Index Patterns and Data Discovery
- Building Visualizations with Pie Charts, Bar Graphs, Line Graphs, and Maps
- Creating Dashboards for Monitoring and Analytics
- Working with Kibana Lens for Simplified Data Exploration
- Advanced Visualizations: Timelion, Vega, Canvas
- Alerts and Reporting in Kibana
- Alarm and triggers in Kibana
- Security and Access Control in Kibana

## Data Shipping with Beats

- Overview of Beats: Filebeat, Metricbeat, Packetbeat, Auditbeat, Heartbeat
- Installing and Configuring Beats
- Collecting and Parsing Log Files with FileBeat
- System and Application Metrics with MetricBeat
- Network Traffic Analysis with PacketBeat

- Security Event and File Integrity Monitoring with AuditBeat
- Uptime Monitoring with HeartBeat
- Sending Data from Beats to Elasticsearch/Logstash

## **Unified Data Collection with Elastic Agent**

- Introduction to Elastic Agent
- Replacing Beats with Elastic Agent
- Configuring Elastic Agent for Data Collection (Log and Metric)
- Centralized Management with Fleet

## **Security and Monitoring in the Elastic Stack**

- Securing the Stack: Role-Based Access Control (RBAC) and Encryption
- HTTPS interfaces and Secure communications
- Auditing and Compliance, Monitoring Access and Changes
- Implementing Security Rules and Alerts
- SIEM (Security Information and Event Management) and SOC Use Cases

## **Advanced Elastic Stack Topics**

- Machine Learning in Elastic Stack: Anomaly Detection and Forecasting
- IoT integration with Elastic Stack
- Advanced alarm and triggers deployment (sending email, SMS, Physical action, etc)
- APM (Application Performance Monitoring): Tracing and Performance Metrics
- Scaling Elasticsearch Clusters, High Availability and Load Balancing
- Backup and restore Strategies for Elasticsearch
- Handling Large Datasets, Index Lifecycle Management (ILM) and Rollups

## Real-World Use Cases and Projects

- Setting Up a Centralized Logging Solution
- Building a Real-Time Monitoring Dashboard for Infrastructure Metrics
- Security Analytics and Threat Detection with the Elastic Stack
- Implementing Application Performance Monitoring (APM) for services
- IoT Management and monitoring platform with elastic stack