AI Engineer

The definitive Master's programme taking you from foundational Python to building advanced Generative AI and Autonomous Agent systems. Become the AI-Native professional the industry is desperately seeking.

Python for AI & Data

Master Python fundamentals through advanced OOP concepts

SQL for AI & Data

PostgreSQL mastery from basics to advanced optimization

PowerBI for Analytics

Transform data into compelling visual stories

Python Framework FastAPI

Build modern, high-performance APIs

GenAI & Agentic AI

Create intelligent autonomous systems

Digital Edify

India's First AI-Native Training Institute

Learn AI. Build Agents. Lead Future.

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About Digital Edify

India's #1 Training Institute for the AI Era

Established: 2016 **Headquarters:** Hyderabad, Telangana **Reach:** Global (Online + Offline)

The Transformation Narrative

Digital Edify has evolved from a premium training institute in the Automation Era to an AI-first organisation leading the Agentic AI revolution. Since 2016, we've transformed over 100,000 professionals and built partnerships with more than 1,000 industry leaders. Our journey reflects the technological evolution of our time—from traditional job placement to career transformation, and now to building AI-native professionals who will shape the future of work.

1

Automation Era (2016-2023)

Premium Training Institute focused on job placement with 100K+ students trained

2

AI Revolution (2024-2025)

AI-Powered Training with industry-AI integration and career transformation focus

3

Agentic AI Leadership (2026+)

AI First Institute building AI-Native Professionals with 1 Million AI-Native Vision

> "We started in the Automation Era. We evolved through the AI Revolution. Now, we're leading the Agentic AI Future—with 100,000+ professionals already transformed and 1,000+ industry partners trusting our graduates."

Vision & Mission

Vision

"To Create 1 Million AI-Native Professionals Who Will Build the Agentic Future of Work"

Mission

"We transform learners into AI-native professionals through industry-aligned programmes that integrate Agentic AI into every discipline—from development to data science to enterprise platforms."

Course Highlights

Section 1: Fundamentals of IT & AI

Learn how applications are built, managed, and enhanced using agile methods, cloud computing, and AI fundamentals.

Section 2: Python for AI & Data

Build a strong Python foundation covering core programming, data structures, OOP, and advanced features for AI and data work.

Section 3: SQL for AI & Data

Design, query, and optimize relational databases using PostgreSQL for analytics and data-driven applications.

Section 4: Power BI for Analytics

Create interactive dashboards and enterprise analytics using data modeling, DAX, and Power BI best practices.

Section 5: Data Engineering with MS Fabric

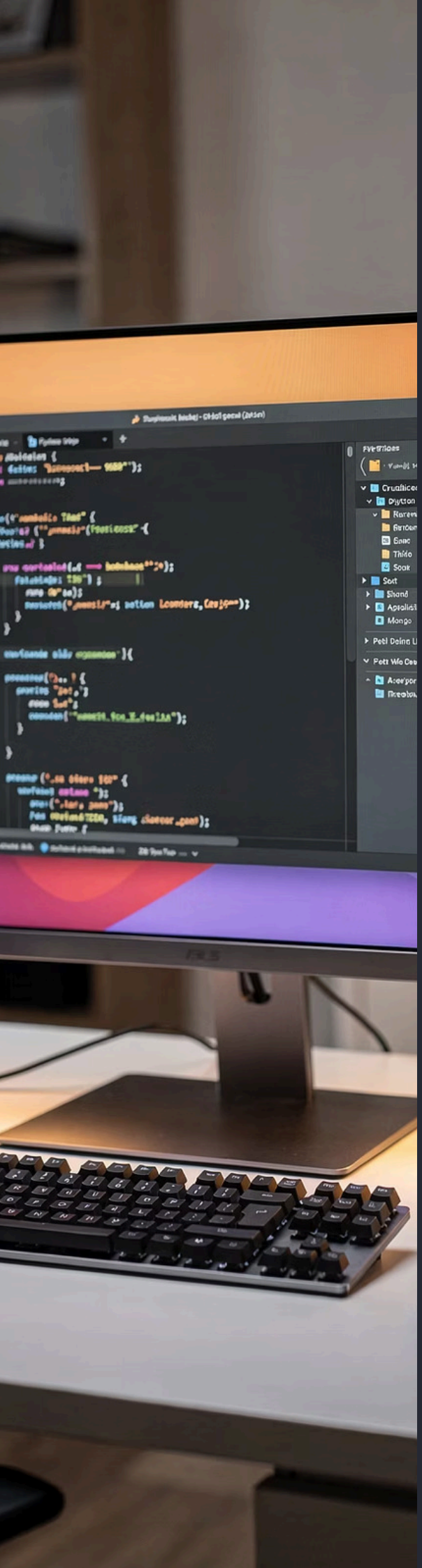
Build end-to-end data platforms using lakehouse architecture, pipelines, real-time analytics, and AI in Microsoft Fabric.

Section 6: Modern Python Framework FastAPI

Develop high-performance, secure, and scalable APIs using FastAPI, async programming, and modern authentication.

Section 7: Generative AI & Agentic AI

Design, deploy, and manage intelligent generative and agentic AI systems using LLMs, RAG, and production workflows.



SECTION 1

Python for AI & Data

Module 1: Python Fundamentals

Begin your journey with comprehensive Python fundamentals. This module establishes the essential foundation for AI development, covering everything from environment setup to control flow structures.

Core Concepts

- Python interpreter installation across Windows and Mac platforms
- IDE configuration with Visual Studio Code
- Mastery of 35 Python keywords and syntax rules
- Variables, memory management, and data types
- Type conversion and casting techniques

Control Structures

- Arithmetic, comparison, and logical operators
- Conditional statements including match-case
- While and for loops with range() function
- Control flow with break, continue, and pass
- User input handling

Module 2: String Manipulation

Strings are fundamental to data processing and AI applications. This module provides comprehensive coverage of string operations, from basic manipulation to advanced formatting techniques essential for text processing in AI systems.

1

String Fundamentals

Definition, rules, indexing (positive and negative), and slicing with start:end:step syntax

2

Operations & Formatting

Concatenation, repetition, f-strings, format() method, and immutability concepts

3

Transformation Methods

Case conversion, search methods (find, index, count), and checking methods (isalpha, isdigit)

4

Advanced Techniques

Trimming (strip, lstrip, rstrip), replacement, split/join operations, and alignment methods

Module 3: Data Structures - Lists & Tuples

Lists: Dynamic Collections

Master Python's most versatile data structure. Lists provide mutable, ordered collections essential for AI data processing.

- Creation, indexing, and slicing operations
- Adding elements: append, insert, extend
- Removing elements: remove, pop, clear
- Searching and counting: index, count
- Sorting and reversing: sort, reverse
- Powerful list comprehensions

Tuples: Immutable Sequences

Understand when and why to use immutable data structures for data integrity and performance.

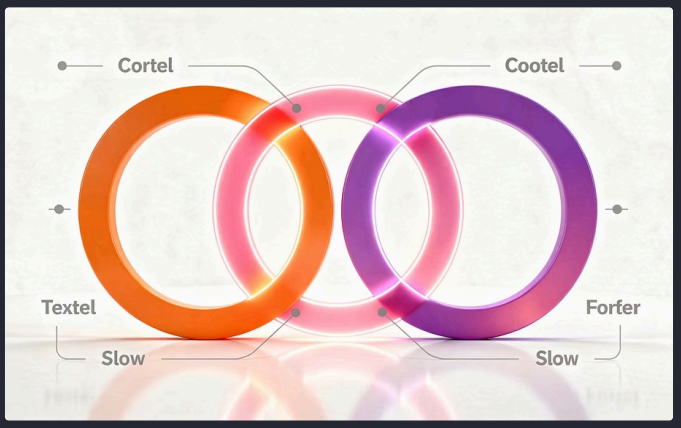
- Tuple creation and operations
- Immutability advantages
- Tuple packing and unpacking
- Performance comparisons with lists
- Use cases in AI applications

Module 4: Data Structures - Dictionaries & Sets

Dictionaries and sets are crucial for efficient data storage and retrieval in AI applications. Master these powerful structures for optimal performance in machine learning pipelines.

Dictionaries

Key-value pair storage with creation, access, operations, keys/values/items methods, comprehensions, and nested structures



Sets

Unique, unordered, unchangeable collections with union, intersection, difference operations and subset/superset checks

Frozen Sets

Immutable set variants for guaranteed data integrity and practical applications in AI systems

Module 5: Advanced Collections & Iterators

Unlock Python's advanced collection types and iteration protocols. These powerful tools enable memory-efficient data processing crucial for large-scale AI applications.

Collections Module

Specialized container datatypes: namedtuple for readable tuples, Counter for counting, defaultdict for default values, deque for efficient queue operations

Iterators & Generators

Iteration protocol, custom iterators, generators with yield statement, generator expressions, and memory efficiency concepts

Functional Programming

Lambda functions, higher-order functions (map, filter, reduce), functional programming concepts, and generator pipelines

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Module 6: Functions & Scope

Functions are the building blocks of modular, reusable code. Master function design patterns essential for creating maintainable AI systems.

01

Function Basics

Definition, calling, parameters, and arguments

02

Argument Types

Positional, keyword, default, *args, and **kwargs

03

Return Values

Return statements and multiple return values

04

Scope Management

Local and global scope with global keyword

05

Function Types

Built-in, user-defined, lambda, and IIFE

06

Advanced Concepts

Docstrings and recursive functions

Module 7: Modules & Packages

Module Mastery

Organize and reuse code effectively through Python's module system. Essential for building scalable AI applications.

Module Types

- Built-in modules (math, random, datetime, os, sys)
- User-defined modules creation
- External packages installation

Importing Techniques

- Various import methods
- Package structure and creation
- __init__.py file purpose
- Nested packages

Package Management

Master pip and dependency management for professional Python development.

Key Skills

- pip package manager usage
- Installing external packages
- requirements.txt management
- Popular packages: requests, pandas, numpy
- Module best practices

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Module 8: Working with Data Formats

Data persistence and exchange are fundamental to AI systems. Master file operations and popular data formats for seamless data integration.

File Operations

CRUD operations, open() function, file modes, reading and writing methods, append mode, and file path operations

Directory Management

Working with os and shutil modules for comprehensive directory and folder management

CSV Files

csv.reader, csv.writer, csv.DictReader, and csv.DictWriter for tabular data processing

JSON Operations

dump, dumps, load, loads for data serialization and deserialization

Module 9: Advanced Python Concepts

Elevate your Python expertise with advanced patterns essential for robust AI applications. Master exception handling, decorators, generators, and context managers.

Exception Handling

try-except-else-finally blocks, catching specific exceptions, raising and re-raising exceptions, custom exception classes, and built-in exception types

Decorators

Function decorators, decorators with arguments, multiple decorators, class decorators, and practical applications for code enhancement

Generators Deep Dive

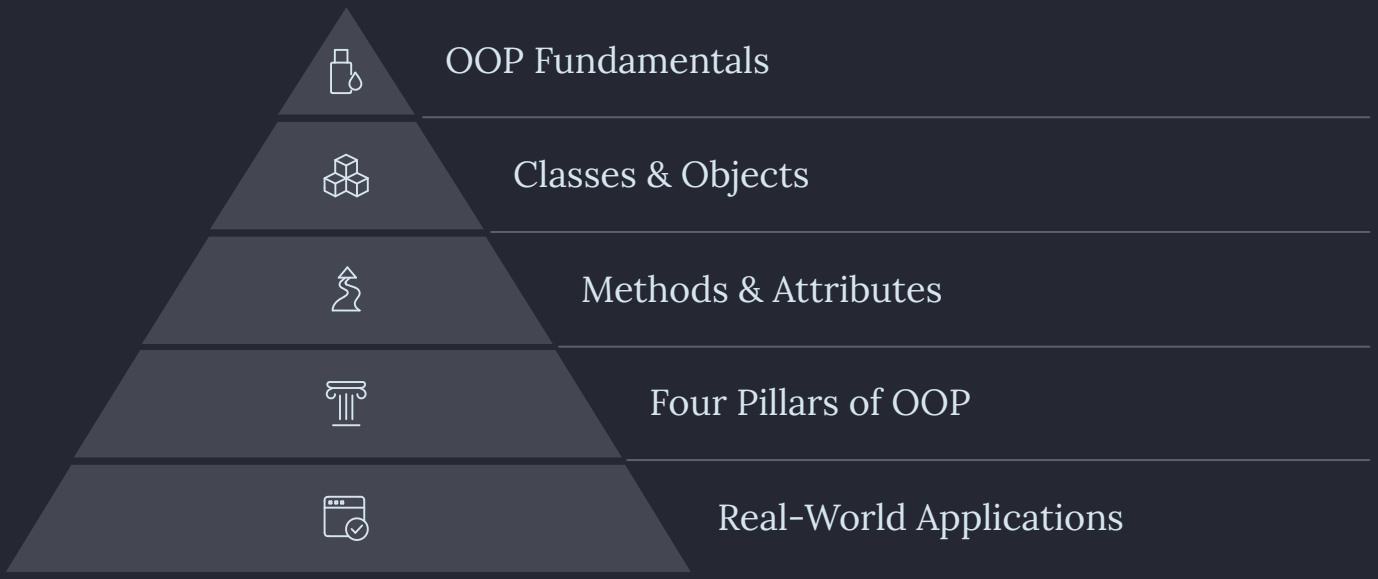
Generator expressions, infinite generators, and memory-efficient iteration patterns

Context Managers

Understanding context managers and creating custom context managers for resource management

Module 10: Object-Oriented Programming

Object-Oriented Programming is the cornerstone of modern software development. Master OOP principles to build scalable, maintainable AI systems with clean architecture.



Comprehensive coverage includes classes and objects, instance and class variables, __init__ constructor, self parameter, instance/class/static methods, and the four pillars: Encapsulation (access modifiers), Inheritance (single, multi-level, multiple), Abstraction (abstract classes and methods), and Polymorphism (method overriding, duck typing). Master method overriding, super() function, special methods (__str__, __repr__, __len__), and abstract base classes.

SECTION 2

SQL for AI & Data

Module 1: Foundations of Databases & PostgreSQL

Establish a solid foundation in relational database management systems. PostgreSQL is the industry-standard open-source database powering modern AI and data applications.

Database Fundamentals

DBMS concepts, RDBMS architecture, and ACID properties ensuring data integrity

PostgreSQL Setup

Installation across platforms, psql command-line tool, and pgAdmin 4 GUI

Database Objects

Databases, schemas, tables, and comprehensive data type coverage

Constraints & Integrity

PRIMARY KEY, FOREIGN KEY, UNIQUE, NOT NULL, CHECK, DEFAULT, and referential integrity

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Module 2: Querying and Analysing Data

Master SQL querying from fundamentals to advanced techniques. Learn to extract, transform, and analyse data efficiently for AI and machine learning workflows.

Basic Queries

- SELECT statement basics
- Column aliases and expressions
- WHERE clause filtering
- Comparison operators
- Logical operators (AND, OR, NOT)
- BETWEEN, IN, LIKE operators
- NULL handling

Data Manipulation

- ORDER BY sorting
- DISTINCT for duplicates
- LIMIT and OFFSET pagination
- String functions
- Numeric functions
- Date and time functions

Advanced Analysis

- Aggregate functions
- GROUP BY and HAVING
- Window functions
- JOIN operations (INNER, LEFT, RIGHT, FULL, CROSS, SELF)
- Multi-table joins
- Join optimization

Module 3: Advanced Queries & Data Manipulation

Elevate your SQL expertise with advanced querying techniques, transaction management, and data manipulation strategies essential for production AI systems.

1 Subqueries

Subqueries in WHERE, SELECT, FROM clauses, correlated subqueries, EXISTS, NOT EXISTS, IN, and NOT IN

2 Common Table Expressions

CTEs for readable queries, recursive CTEs for hierarchical data, and multiple CTEs

3 Set Operations

UNION, UNION ALL, INTERSECT, and EXCEPT for combining query results

4 Data Modification

UPDATE statements with expressions and JOINs, DELETE with subqueries, TRUNCATE vs DELETE

5 Transaction Management

BEGIN, COMMIT, ROLLBACK, savepoints, isolation levels, and concurrency control

Module 4: Database Programming & Automation

Transform from SQL user to database programmer. Master stored functions, procedures, triggers, and automation techniques for intelligent data systems.

Schema Evolution

ALTER TABLE operations, adding/modifying/dropping columns, managing constraints, and schema versioning

Performance Optimization

Index types (B-tree, Hash, GIN, GiST), creating and managing indexes, and strategic index usage

Views & Abstraction

Creating views, updatable views, materialized views, and refreshing strategies

PL/pgSQL Programming

Stored functions, parameters, return types, control structures (IF, CASE, LOOP), table-returning functions

Procedures & Triggers

Stored procedures, exception handling, BEFORE/AFTER/INSTEAD OF triggers, audit logging, data validation

Module 5: Database Design & Optimization

Design robust, scalable databases that power high-performance AI applications. Master normalization, optimization, and performance tuning techniques.

ER Modelling

Entities, attributes, relationships, relationship types (1:1, 1:M, M:N), and ER diagrams

Normalization

First, Second, and Third Normal Forms, benefits, trade-offs, and denormalization strategies

Design Best Practices

Naming conventions, data type selection, primary and foreign key strategies

Query Optimization

EXPLAIN and EXPLAIN ANALYZE, execution plans, index strategies, query rewriting

Performance Tuning

Database statistics (ANALYZE), VACUUM maintenance, connection pooling, table partitioning

SECTION 3

PowerBI for Analytics

Module 1: Introduction to Business Intelligence & Power BI

Business Intelligence fundamentals and modern analytics, Power BI components and architecture, interface navigation and first report creation, understanding Desktop vs. Service capabilities

Module 2: Connecting to Data Sources

File, database, cloud, and web source connectivity, Import vs. DirectQuery vs. Live Connection, data source settings and credential management, performance considerations for connection modes

Data Preparation & Modelling

Module 3: Data Preparation & Transformation

Power Query is the engine for data transformation in Power BI. Master the interface and applied steps for reproducible data preparation.

- Power Query interface and applied steps
- Data profiling and quality assessment
- Essential transformations: filtering, splitting, merging
- Reshaping: pivot, unpivot, grouping
- Combining queries: append and merge operations

Module 4: Data Modelling & Relationships

Proper data modelling is crucial for performant, maintainable Power BI solutions.

- Star schema vs. snowflake schema design
- Creating and managing table relationships
- Primary and foreign keys
- Hierarchies and date dimension tables
- Data model optimization strategies

Visual Reports & DAX Fundamentals

Module 5: Building Visual Reports

Data visualization principles, core visualizations (charts, tables, maps, KPIs), interactive elements (slicers, filters, bookmarks, drill-through), dashboard layout, mobile optimization, and storytelling with data

Module 6: Introduction to DAX

DAX syntax and structure, calculated columns vs. measures, essential functions (aggregation, logical, text, date/time), CALCULATE and FILTER functions, creating KPIs and business metrics

These modules transform raw data into compelling visual narratives. Master visualization principles to choose the right chart types, create interactive experiences with slicers and drill-through, and optimize for mobile viewing. DAX (Data Analysis Expressions) unlocks advanced analytics capabilities, enabling sophisticated calculations and business metrics.

Advanced Analytics & Deployment

01

Module 7: Time Intelligence & Advanced DAX

YTD, MTD, QTD functions, prior period comparisons, filter vs. row context, variables, iterator functions, DAX optimization

02

Module 8: Advanced Visualizations

Custom visuals from AppSource, advanced chart types, R and Python integration, AI visuals (Key Influencers, Q&A), dynamic visuals with parameters

Time intelligence functions enable powerful temporal analysis, comparing current performance against historical periods. Advanced visualizations including waterfall charts, funnel charts, and decomposition trees provide deeper insights. AI-powered visuals like Key Influencers automatically discover patterns in your data.

Enterprise Power BI

Module 9: Publishing & Collaboration

Move from development to production with enterprise-grade deployment strategies.

- Publishing and workspace management
- Dashboards vs. reports
- Data refresh and gateway configuration
- Sharing strategies and Power BI apps
- Integration with Teams, SharePoint, Excel, PowerPoint

Module 10: Governance & Administration

Enterprise deployment requires robust governance and security.

- Admin portal and tenant settings
- Row-Level Security (RLS) and Object-Level Security (OLS)
- Incremental refresh and aggregations
- Dataflows and deployment pipelines
- Performance optimization and capacity management
- APIs and embedded analytics

SECTION 4

Data Engineering with MS Fabric

Module 1: Introduction to Microsoft Fabric

Microsoft Fabric represents the future of unified analytics. This comprehensive platform integrates data engineering, data science, real-time intelligence, and business intelligence into a single SaaS solution.

Fabric Workloads

Data Factory, Data Engineering, Warehouse, Science, Real-Time Intelligence, and Power BI unified in one platform

Licensing & Capacity

Capacity units from F2 to F2048, workspaces, and tenant structure for enterprise deployment

Platform Comparisons

Comparisons with Databricks and Snowflake, migration paths from Azure Synapse

Module 2: OneLake - The Unified Data Lake

OneLake is Fabric's revolutionary unified data lake, providing a single storage layer for all analytics workloads. Built on Delta Lake format, it ensures ACID transactions and seamless data access.

OneLake Architecture

Unified storage layer with Delta Lake and Parquet file formats ensuring data consistency

ACID Transactions

Atomicity, consistency, isolation, durability with versioning and time travel capabilities

OneLake Shortcuts

Connect to external data sources without data movement, enabling federated queries

Catalog & Discovery

OneLake Catalog for data discovery, security, and access control across the organization

Module 3: Lakehouse Architecture

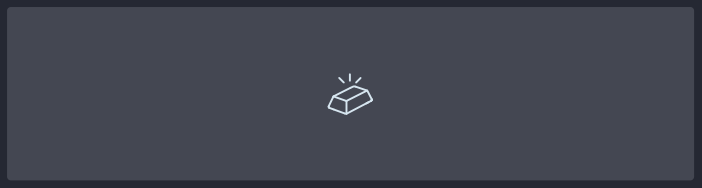
The Lakehouse combines the best of data lakes and data warehouses, providing structured and unstructured data storage with SQL analytics capabilities. Master the medallion architecture for data quality and governance.

Bronze Layer

Raw data ingestion

Silver Layer

Cleaned and validated data



Gold Layer

Business-ready aggregated data

Additional topics include creating and managing Lakehouses, SQL Analytics Endpoint for querying, Delta table operations and optimization, and time travel queries for historical analysis.

Module 4: Data Factory & Data Integration

Data Factory in Fabric provides comprehensive data integration capabilities, from simple data movement to complex ETL pipelines. Master dataflows, pipelines, and database mirroring for real-time data synchronization.

Data Pipelines

Creation, configuration, and orchestration with error handling

Dataflows Gen2

Power Query and M language for data transformation

Database Mirroring

Real-time sync from Azure SQL, Cosmos DB, PostgreSQL

CI/CD

Continuous integration and deployment for pipelines

Module 5: Data Engineering with Apache Spark

Apache Spark in Fabric provides distributed computing power for big data processing. Master PySpark for scalable data transformations and leverage AI functions for intelligent data processing.

Apache Spark in Fabric

Distributed computing engine integrated with Fabric Notebooks and Copilot assistance

PySpark DataFrames

DataFrame API for distributed data processing and transformations at scale

Spark SQL

SQL queries on distributed data with optimization techniques for performance

Job Definitions

Spark job definitions and scheduling for automated data processing workflows

AI Functions

Built-in AI capabilities: summarization, classification, and PII obfuscation

Module 6: Data Warehouse

Fabric Data Warehouse provides enterprise-grade SQL analytics with T-SQL support. Design star schemas, implement slowly changing dimensions, and optimize for analytical workloads.

Warehouse Fundamentals

- Fabric Data Warehouse overview
- T-SQL support and user-defined functions
- Schema design and table management
- Star schema and dimensional modelling

Advanced Techniques

- Slowly Changing Dimensions (SCD) implementation
- SQL Database in Fabric
- Performance optimization strategies
- Query tuning and indexing

Module 7: Real-Time Intelligence

Real-Time Intelligence in Fabric enables streaming analytics and real-time insights. Master Eventstreams, Kusto Query Language (KQL), and real-time dashboards for operational intelligence.

1. **Eventstreams**
   Streaming data ingestion from multiple sources
2. **KQL Databases**
   Eventhouse and KQL for time-series analytics
3. **Graph & Maps**
   Relationship modelling and geospatial analytics
4. **Real-Time Dashboards**
   Live visualizations and alerting

Module 8: Power BI & Semantic Models

Power BI integration with Fabric unlocks Direct Lake mode for lightning-fast analytics. Master semantic models, DAX, and security for enterprise reporting.

Direct Lake Mode

Revolutionary storage mode reading directly from OneLake without data movement

Semantic Models

Relationships, DAX fundamentals, and business logic layer

Security

Row-level security (RLS) and object-level security (OLS) implementation

Optimization

Incremental refresh, aggregations, and report development with Copilot

Module 9: Data Science in Fabric

Data Science in Fabric provides integrated machine learning capabilities. From exploratory analysis to model deployment, master the complete ML lifecycle within Fabric.

Exploratory Data Analysis

Data profiling and visualization in notebooks

Model Training

ML model development and versioning

MLflow Integration

Experiment tracking and model registry

Semantic Link

SemPy for Power BI integration

Batch Scoring

Predictions at scale

Module 10: AI & Copilot in Fabric

Notebooks

AI-assisted code generation

SQL & KQL

Natural language to queries

AI Functions

Azure AI Foundry integration

Pipelines

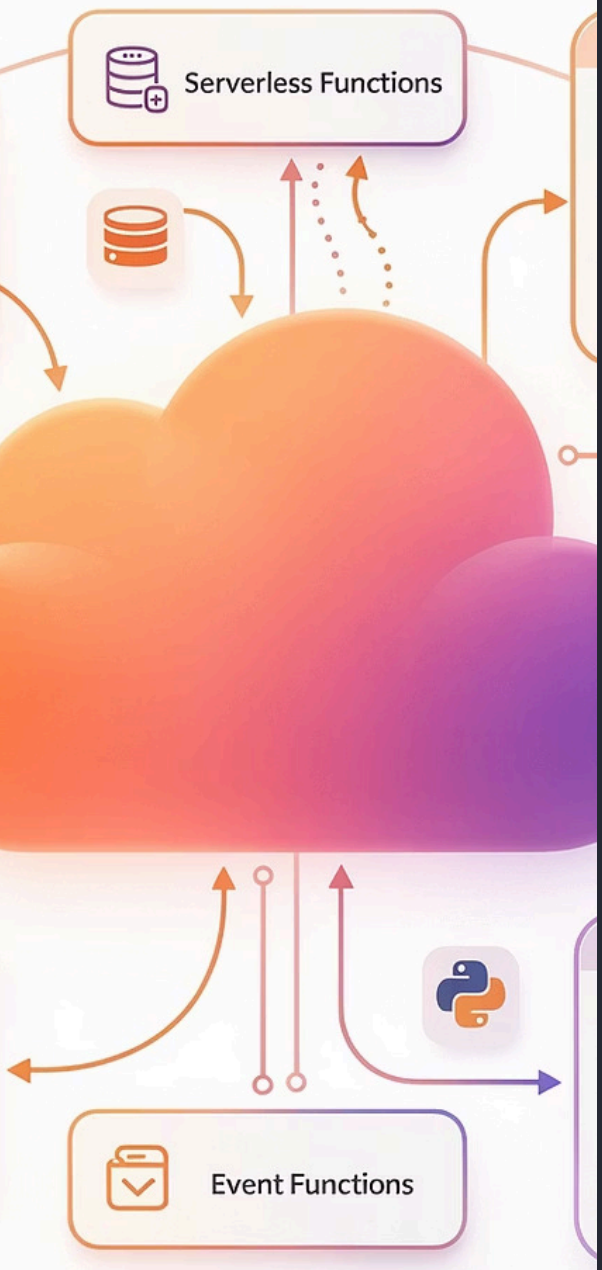
Automated workflow creation

Data Agents

Conversational AI interfaces

Reports

Intelligent report building



Module 11: User Data Functions

User Data Functions bring serverless Python functions to Fabric. Develop custom logic in VS Code, deploy seamlessly, and integrate with Notebooks, Pipelines, and SQL for extensible data processing.

1

Overview

Serverless Python functions for custom logic

2

Development

VS Code extension for local development

3

Integration

Use in Notebooks, Pipelines, and SQL

4

Deployment

Testing and production deployment

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Module 12: Security & Governance

Enterprise data platforms require robust security and governance. Master Fabric's comprehensive security model, from authentication to data masking, ensuring compliance and data protection.

Security Model

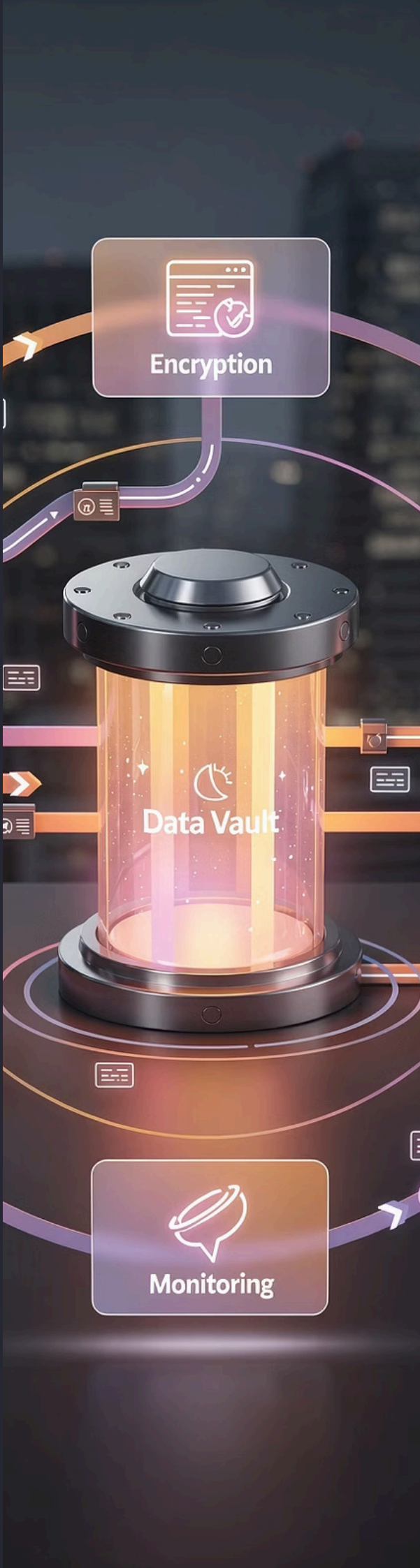
Authentication, authorization, and identity management across Fabric workloads

Data Protection

Row-level, column-level security, and dynamic data masking for sensitive information

Microsoft Purview

Integration for data lineage, catalog, compliance, and auditing capabilities



Module 13: Administration & Monitoring

Effective administration ensures optimal performance and cost management. Master the admin portal, capacity management, monitoring tools, and CI/CD patterns for enterprise Fabric deployments.

Administration

- Fabric admin portal and tenant settings
- Capacity management and SKUs
- User and workspace management
- Cost optimization strategies

Monitoring & DevOps

- Monitoring Hub and performance dashboards
- Query and pipeline monitoring
- Git integration and deployment pipelines
- CI/CD patterns for Fabric

Module 14: Advanced Topics & Best Practices

Elevate your Fabric expertise with advanced optimization techniques, enterprise architecture patterns, and migration strategies. Learn to build scalable, performant data platforms.

Performance Optimization

Query optimization, partition strategies, and caching techniques

Enterprise Architecture

Architecture patterns and data mesh implementation

Migration Strategies

Moving from legacy systems to Fabric

Developer Tools

Fabric CLI, APIs, and extensibility

Integration

Azure and third-party service integration

Module 15: Certification Preparation

Validate your Fabric expertise with Microsoft certifications. Prepare for DP-600 and DP-700 exams with comprehensive coverage of exam objectives, practice tests, and hands-on labs.

DP-600

Fabric Analytics Engineer

Core certification covering all Fabric workloads

DP-700

Fabric Data Engineer

Specialized certification for data engineering

Exam preparation includes understanding exam structure and skills measured, practice test strategies aligned with Microsoft's assessment approach, and hands-on labs that mirror real-world scenarios and exam questions.

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SECTION 5

Modern Python Framework FastAPI

Module 1: FastAPI Fundamentals & Setup

FastAPI is the modern, high-performance web framework for building APIs with Python. Leveraging async capabilities and automatic validation, FastAPI outperforms Flask and Django whilst providing superior developer experience.

Performance Boost

Faster than Flask and Django

Type Safety

Automatic validation with Pydantic

Boilerplate Code

Auto-generated documentation

Topics include Python prerequisites, framework comparisons, virtual environment setup, installing FastAPI and Uvicorn, creating your first API endpoint, path operations (GET, POST, PUT, DELETE), understanding decorators, auto-generated documentation (Swagger UI & ReDoc), and running the development server.

Module 2: Path Parameters, Query Parameters & Request Body

Master the three primary ways to receive data in FastAPI: path parameters for resource identification, query parameters for filtering and options, and request bodies for complex data structures.

Path Parameters

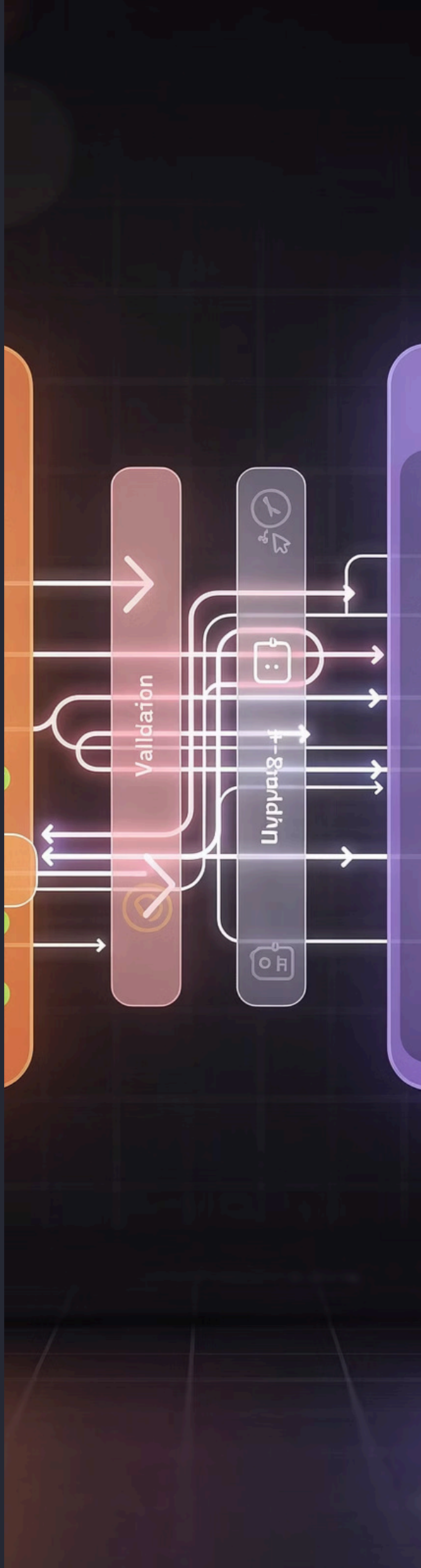
Defining path parameters, type hints and validation, path parameters with Enums for restricted values

Query Parameters

Required vs optional parameters, default values, multiple parameters for complex filtering

Request Body

Pydantic BaseModel classes, automatic data validation, nested models, optional fields, response models



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Module 3: Database Integration with SQLAlchemy

Integrate PostgreSQL with FastAPI using SQLAlchemy ORM. Master database models, session management, and CRUD operations for production-ready data persistence.

01

ORM Setup

Introduction to ORMs, SQLAlchemy setup and configuration

02

Models & Sessions

Creating database models, session management with dependency injection

03

Schemas

Pydantic schemas vs SQLAlchemy models separation

04

CRUD Operations

Create, Read, Update, Delete records

05

Migrations

Database migrations with Alembic

06

Relationships

One-to-Many and Many-to-Many relationships

Module 4: API Routers & Project Structure

Scale your FastAPI application with modular architecture. APIRouter enables clean code organization, whilst dependency injection and the repository pattern ensure maintainable, testable code.

Code Organization

- Organizing code with APIRouter
- Creating modular routers (blogs, users, auth)
- Router prefixes and tags
- Including routers in main app

Error Handling

- Response status codes
- HTTPException for error handling
- Custom exception handlers

Design Patterns

- Repository pattern for database operations
- Dependency injection deep dive
- Environment variables with python-dotenv

Configuration

- CORS configuration
- Project structure best practices

Module 5: Authentication & Security

Secure your FastAPI application with industry-standard authentication. Implement JWT-based authentication, password hashing, and role-based access control for production-ready security.

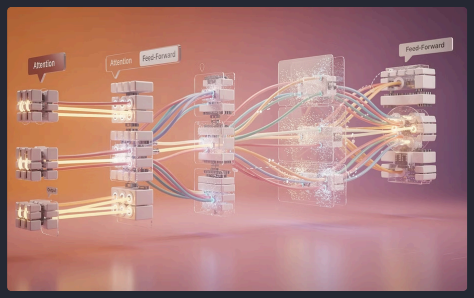
1. **Password Security**
   Password hashing with Bcrypt and user registration endpoint
2. **OAuth2 Flow**
   OAuth2 Password Flow implementation
3. **JWT Tokens**
   Creating access tokens, token expiration, and verification
4. **Protected Routes**
   OAuth2PasswordBearer dependency and route protection
5. **User Management**
   Getting current user from token, login/logout functionality
6. **Authorization**
   Role-Based Access Control (RBAC) basics and API testing

SECTION 6

Generative AI & Agentic AI

Module 1: Foundations of Generative AI

Large Language Models represent the most significant breakthrough in artificial intelligence. Understand transformer architecture, compare major LLMs, and master model selection for optimal performance and cost.



LLM Fundamentals

Large Language Models, transformer architecture, and tokenization mechanisms

Model Comparison

GPT, Claude, Gemini, DeepSeek - evolution from GPT-1 to 2026 frontier models

Model Selection

Choosing models for different use cases and cost optimization strategies

Module 2: Prompt Engineering & Context Design

Prompt engineering is the art and science of communicating with LLMs. Master advanced techniques to reduce hallucinations, optimize reasoning, and design domain-specific prompts for maximum effectiveness.

Advanced Techniques

Prompt engineering and context engineering for optimal LLM performance

Reasoning Optimization

Reasoning mode optimization and reducing hallucinations

Prompting Strategies

Zero-shot, few-shot, and chain-of-thought prompting

Multimodal Prompting

Text, image, and audio prompting for diverse applications

Domain-Specific Design

Crafting prompts for specialized domains and use cases

Module 3: LLM APIs & LangChain 1.0

LangChain 1.0 revolutionizes LLM application development with create_agent abstraction and middleware systems. Master multi-provider integration, function calling, and cost-optimized pipelines.

LLM APIs

OpenAI, Anthropic, Google, and DeepSeek API integration

LangChain 1.0

Fundamentals, create_agent abstraction, and middleware systems

Multi-Provider

Integration, streaming, batching, and function calling

Optimization

Structured outputs and cost-optimized pipelines

Module 4: RAG & Vector Databases

Retrieval-Augmented Generation (RAG) combines LLMs with external knowledge bases. Master vector databases, build production RAG pipelines, and implement agentic RAG for self-improving retrieval systems.

Vector Databases

ChromaDB, Pinecone, Qdrant

Document Processing

Processing at scale

Hybrid Search

Semantic and keyword

Production RAG

Building scalable pipelines

Agentic RAG

Self-improving retrieval

MCP-Enhanced

Model Context Protocol

Module 5: Production Deployment

Deploy your AI applications to production with confidence. Master Streamlit and Gradio for user interfaces, LangGraph Platform for scalable deployment, and implement AI governance for EU AI Act compliance.

User Interfaces

- Streamlit for rapid prototyping
- Gradio for interactive demos
- Custom UI development

Operations

- Cost optimization strategies
- API security and rate limiting
- Monitoring and observability

Deployment

- LangGraph Platform deployment
- Scaling strategies
- Integration with enterprise tools

Governance

- AI governance frameworks
- EU AI Act compliance

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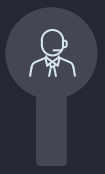
Module 6: Introduction to Agentic AI

Agentic AI represents the next evolution of artificial intelligence. Agents can plan, reason, and act autonomously, integrating tools and making decisions. Master LangChain 1.0 Agents with middleware and Model Context Protocol (MCP).

Agentic AI Fundamentals

Plan, reason, and act - the core capabilities of autonomous agents



LangChain 1.0 Agents

Agents with middleware for customization and control

Model Context Protocol

MCP for standardized agent communication

Tool Integration

Patterns for integrating external tools and APIs

Enterprise Adoption

Use cases and design patterns for production systems

Module 7: LangGraph 1.0 Fundamentals

LangGraph 1.0 provides graph-based orchestration for complex AI workflows. Master state management, node caching for development efficiency, and pre/post hooks for guardrails.

LangGraph Architecture

Graph-based logic for complex AI workflows and state management

Node Caching

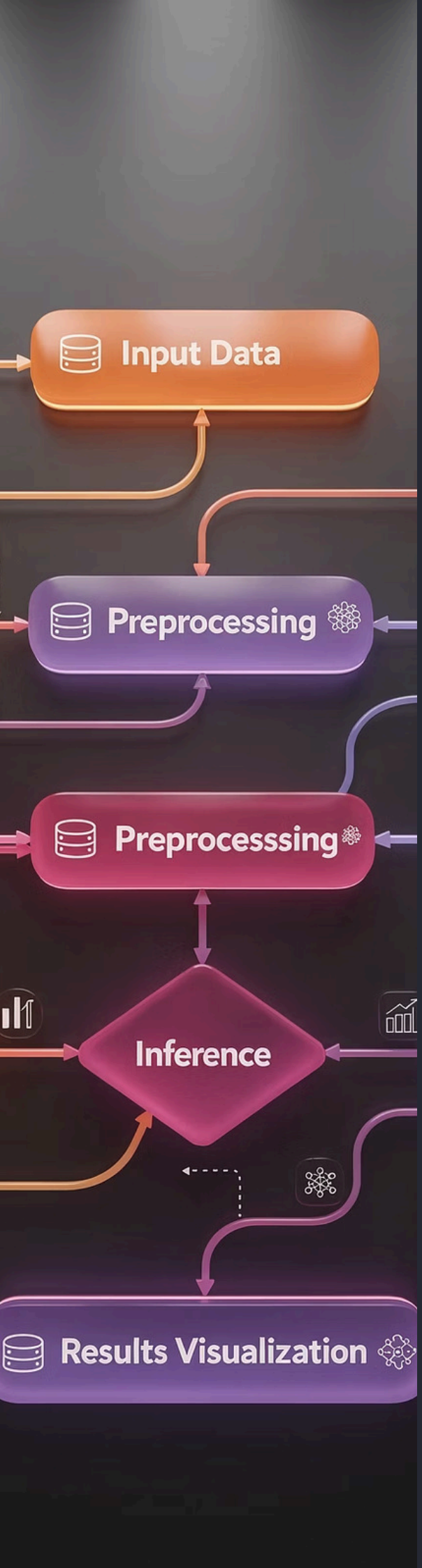
Development efficiency with cached nodes for rapid iteration

Pre/Post Hooks

Guardrails for safety and compliance throughout workflows

AI Workflows

Building production AI workflows with LangGraph



Module 8: Advanced Workflow Patterns

Master sophisticated workflow patterns for production AI systems. Implement parallel execution, conditional routing, iterative refinement, and quality-gated content generation.

Parallel Execution

Deferred nodes for concurrent processing

Conditional Routing

Decision trees for dynamic workflows

Iterative Refinement

Loops for continuous improvement

Type-Safe Streaming

Real-time output with type safety

Real-world applications include essay evaluation systems with automated grading, customer feedback routing to appropriate departments, multi-stage approval workflows for content, and quality-gated content generation ensuring output standards.

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Module 9: Persistence & Human-in-the-Loop

Production AI systems require durable state management and human oversight. Implement persistence with PostgreSQL and Redis, enable human-in-the-loop workflows, and support multi-day processes with restart capabilities.

Durable State Management

Built-in persistence with PostgreSQL and Redis for reliable state storage

Human-in-the-Loop (HITL)

Implementations for human oversight and approval in AI workflows

Multi-Day Workflows

Support for long-running processes spanning multiple days

Enterprise Compliance

Audit trails for regulatory compliance and governance

Failure Recovery

Restart and recovery mechanisms for robust production systems

Module 10: Production Agentic Systems

Deploy enterprise-grade agentic AI systems with confidence. Master LangGraph Platform deployment, multi-agent system design, and implement comprehensive security, monitoring, and compliance measures.

LangGraph Platform

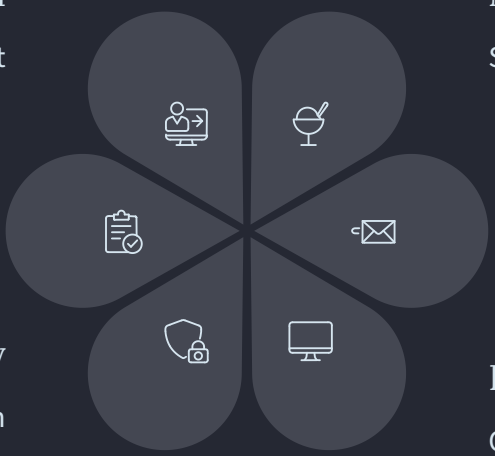
Production deployment

Compliance

Audit trails and guardrails

MCP Security

Security model and injection prevention



Multi-Agent Design

System architecture

Google A2A Protocol

Agent-to-agent communication

LangSmith

Observability and monitoring