Roadmap for Agentic AI

1. Python & Core Programming

Skill	Why It's Needed	Focus / Hands-On
Advanced Python (OOP, decorators, context managers)	Core language for AI agents; modular & maintainable code	Build utility libraries, reusable modules
Async Programming (`asyncio`)	Handle multiple tasks or API calls concurrently	Implement async data fetchers, concurrent agent calls
Logging & Exception Handling	Debugging and monitoring production agents	Add structured logging to pipelines
Type Hints & Static Analysis	Reduce runtime errors and improve maintainability	Use `mypy` and `pylint`
WebSockets (FastAPI / Socket.IO)	Real-time agent communication (streaming LLM output)	Build streaming chat demo with LLM tokens
File I/O & Config Management	Agents need to read/write config, models, documents	Use .yaml or .env for configs
Git/GitHub	Version control, collaboration	Branching, PR workflow, commit discipline

2. Math, Stats & Machine Learning

Skill	Why It's Needed	Focus / Hands-On

Linear Algebra & Calculus	Understanding embeddings, gradients, attention mechanisms	Implement simple linear algebra operations in Python
Probability & Statistics	Essential for model evaluation, uncertainty, RAG retrieval scoring	Build notebooks for probability experiments & hypothesis tests
ML Fundamentals (Supervised/Unsupervised)	Core for embeddings, classifiers, similarity searches	Train small sklearn pipelines, evaluate metrics
Feature Engineering & Evaluation	High-quality inputs = better agent output	Build feature pipelines & test embeddings

3. Deep Learning & LLMs

Skill	**Why It’s Needed**	**Focus / Hands-On**
Neural Networks (CNN, RNN, Transformers)	Underlying technology for embeddings & LLMs	Implement small Transformer models in PyTorch
Embeddings	Convert text/data into vector space for search	Use `sentence-transformers`, visualize vectors
Transformers & Attention	Understand how LLMs generate context-aware outputs	Inspect attention matrices, fine-tune small models
Prompt Engineering (Zero/Few-shot, CoT, ReAct)	Agents act and reason based on prompts	Experiment with prompts for reasoning tasks

RAG (Retrieval-Augmented Generation)	Ground agent responses in knowledge, reduce hallucination	Build document Q&A bot using FAISS/Pinecone

4. Agentic AI Systems

Skill	Why It’s Needed	Focus / Hands-On
Multi-Agent Systems (Planner, Worker, Committee)	Complex tasks decomposed across agents	Implement planner-worker agent to solve multi-step problems
Memory Management (Short-term, Long-term)	Maintain context for multi-turn interactions	Store conversation in vector DB and recall relevant info
LangChain / LlamaIndex	Frameworks to orchestrate agents	Build chain of tools → memory → LLMs
Agent Orchestration & Tool Integration	Agents need to call APIs, DBs, tools	Integrate web search, calculator, or knowledge DB into agent

5. Backend & Production Engineering

Skill	Why It’s Needed	Focus / Hands-On
REST APIs (FastAPI/Flask)	Agents exposed as services	Create endpoints to query agents
WebSockets	Real-time streaming outputs	Stream LLM tokens to frontend for chat
Docker & Docker Compose	Containerized agents for reproducible environments	Containerize agent pipelines

CI/CD (GitHub Actions/Jenkins)	Automated builds, tests, deployment	Build pipeline for ML + agents
Caching & Performance Optimization	Reduce LLM API cost, improve response time	Use Redis/memory caching for frequent queries
Logging, Monitoring & Observability	Track agent performance and failures	Integrate OpenTelemetry + Grafana dashboards

6. Cloud & Deployment

- AWS Core Services: EC2, S3, IAM, Lambda, API Gateway
- Serverless: Deploy lightweight agent functions
- Bedrock (if available) for managed LLMs
- Infrastructure as Code (Terraform basics)
- Scaling & Load Balancing

7. Security & Reliability

- Prompt injection & guardrails
- Input validation & sanitization
- Secrets management (AWS Secrets Manager / Vault)
- Testing: unit, integration, load testing

8. Delivery & Portfolio

- Documentation (README, runbooks)
- Architecture diagrams (Draw.io / Mermaid)
- Full-stack agentic AI platform (RAG + Multi-agent + Frontend + Deployment)

Tip: Tick off each skill as you study and implement. This roadmap ensures you’re fully confident and industry-ready for building agentic AI platforms.

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Portfolio