

Oracle Cloud Infrastructure Generative AI Professional

Student Guide
S1107455GC10



Copyright © 2024, Oracle and/or its affiliates.

Disclaimer

This document contains proprietary information and is protected by copyright and other intellectual property laws. The document may not be modified or altered in any way. Except where your use constitutes "fair use" under copyright law, you may not use, share, download, upload, copy, print, display, perform, reproduce, publish, license, post, transmit, or distribute this document in whole or in part without the express authorization of Oracle.

The information contained in this document is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

Restricted Rights Notice

If this documentation is delivered to the United States Government or anyone using the documentation on behalf of the United States Government, the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs) and Oracle computer documentation or other Oracle data delivered to or accessed by U.S. Government end users are "commercial computer software" or "commercial computer software documentation" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, reproduction, duplication, release, display, disclosure, modification, preparation of derivative works, and/or adaptation of i) Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs), ii) Oracle computer documentation and/or iii) other Oracle data, is subject to the rights and limitations specified in the license contained in the applicable contract. The terms governing the U.S. Government's use of Oracle cloud services are defined by the applicable contract for such services. No other rights are granted to the U.S. Government.

Trademark Notice

Oracle®, Java, MySQL, and NetSuite are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

Third-Party Content, Products, and Services Disclaimer

This documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

101112024

Table of Contents

- OCI 2024 Generative AI Professional** **12**
 - For whom is this course intended? 13
 - Course Outline #1: Fundamentals of Large Language Models 15
 - Course Outline #2: Dive-deep on OCI Generative AI Service 16
 - Course Outline #3: Build an LLM App using OCI Generative AI Service 17
 - Meet your instructors 18
 - Measuring Your Progress: Take the Skill Checks to Test Your Knowledge 19
 - Get the Answers You Need: Use our "Ask Your Instructor" Form or Join the OU Community 20
 - Best practices and retention tips 21
 - Keep Progressing: You're on Your Way to Success! 22
 - Get the Answers You Need: Use our "Ask Your Instructor" Form or Join the OU Community 20
 - Best practices and retention tips 21
 - Keep Progressing: You're on Your Way to Success! 22
- Introduction to Large Language Models** **23**
 - What is a Large Language Model? 24
 - This Module 32
- LLM Architectures** **33**
 - Encoders and Decoders 34
 - Model Ontology 35
 - Encoders 36
 - Decoders 37
 - Encoders -Decoders 38
 - Architectures at a glance 39

Prompting and Prompt Engineering	40
Affecting the distribution over Vocabulary	41
Affecting the distribution over Vocabulary	42
Prompting	43
Prompt Engineering	46
In-context Learning and Few-shot Prompting	47
Example Prompts	49
Advanced Prompting Strategies	50
Issues with Prompting	53
Prompt Injection	54
Memorization	56
Training	57
Training	58
Hardware Costs	60
Decoding	61
Decoding	62
Greedy Decoding	64
Non-Deterministic Decoding	67
Temperature	72
Hallucination	76
Hallucination	77
Groundedness and Attributability	79
LLM Applications	80
Retrieval Augmented Generation	81
Code Models	82

Multi-Modal	83
Language Agents	84
OCI Generative AI Introduction	85
OCI Generative AI Service	86
How does OCI Generative AI service work?	87
Pretrained Foundational Models	88
Fine-tuning	89
Dedicated AI Clusters	90
Demo Generative AI service Walkthrough	91
Chat Models	92
Tokens	93
Pretrained Chat Models	94
Chat Model Parameters	95
Preamble Override	96
Temperature	97
Chat Model Parameters	98
Top k	99
Top p	100
Frequency and Presence Penalties	101
Demo Chat Models	102
Demo OCI Generative AI Service Inference API	103
Demo Setting up OCI Config for Generative AI API	104
Embedding Models	105
Embeddings	106
Word Embeddings	107

Semantic Similarity	108
Sentence Embeddings	109
Embeddings use case	110
Embedding Models in Generative AI	111
Embedding Models in Generative AI	112
Demo Embedding Model	113
Prompt Engineering	114
Prompt & Prompt Engineering	115
LLMs as next word predictors	116
Aligning LLMs to follow instructions	117
In-context Learning and Few-shot Prompting	118
Prompt Formats	119
Advanced Prompting Strategies	120
Customize LLMs with your data	121
Training LLMs from scratch with my data?	122
In-context Learning/□Few shot Prompting.....	123
Fine-tuning a pretrained model	124
Fine-tuning Benefits	125
Retrieval Augmented Generation (RAG)	126
Customize LLMs with your data	127
Fine-tuning and Inference in OCI Generative AI	130
Fine-tuning and Inference	131
Fine-tuning workflow in OCI Generative AI	132
Inference workflow in OCI Generative AI	133
Dedicated AI Clusters	134
T-Few Fine-tuning	135

T-Few fine-tuning process	136
Reducing Inference costs	137
Inference serving with minimal overhead	138
Dedicated AI Clusters Sizing and Pricing	139
Dedicated AI Cluster Units	140
Dedicated AI Cluster Units Sizing	141
Dedicated AI Clusters Sizing	142
Example Pricing	143
Demo Dedicated AI Clusters	144
Generative AI Fine-tuning Configuration	145
Fine-tuning Configuration	146
Fine-tuning Parameters (T-Few)	147
Understanding Fine-tuning Results	148
Demo Fine-tuning and Custom Models	149
Demo Inference using Endpoint	150
OCI Generative AI Security	151
Dedicated GPU and RDMA Network	152
Model Endpoints	153
Customer Data and Model Isolation	154
Generative AI leverages OCI Security Services	155
Retrieval Augmented Generation	156
Retrieval Augmented Generation	157
RAG Framework	158
RAG Techniques	159
RAG Pipeline	160

RAG Application	161
RAG Evaluation	162
Vector Databases	163
LLM Versus LLM + RAG	164
Vector	165
Embedding Distance	167
Similar Vectors	168
Vector Database Workflow	169
Vector Databases	170
Role of Vector Databases with LLMs	171
Keyword Search	173
Keyword Search	174
Semantic Search	176
Semantic Search	177
Embeddings	178
Dense Retrieval	179
Rerank	180
Hybrid Search --> Sparse + Dense	181
Oracle 23ai	182
AI Vector Search	183
Use Case	184
Benefits	185
Oracle AI Vector Search	186
Oracle AI Vector Search Workflow	187
Vector Datatype	188
Vector Distance Function	189

ONNX compatible	190
Database-Native Vector Embedding Generation	191
Vector Index	192
Vector Index Syntax	193
Similarity Searches in Oracle 23ai	194
Vector Search SQL	195
Vector Search	196
AI Vector Search powers Gen AI pipelines	197
Application□Development	198
Chatbot Introduction	199
Chatbot Introduction	200
Demo Chtbot	201
Chatbot Architecture & Basic Components	202
Chatbot Architecture	203
OCI Generative AI and LangChain Integration	204
LangChain Components	205
Models, Prompts and Chains	206
LangChain Prompt, Model and Chain Interaction	207
LangChain Prompt Templates	208
String Prompt Template and PromptValue	209
Chat Prompt Template and PromptValue	210
LangChain Models	211
LangChain Models – OCI Chat Models	212
LangChain Models – OCI Embedding Models	213
LangChain Chains	214
LangChain Chains	215

Setting Up a Development Environment	216
Demo Setup Development Environment	217
Demo Prompts, Chains, and LLMs	218
Extending Chatbot by Adding Memory	219
LangChain Memory	220
Memory	221
Memory Chat Messages	222
LangChain Memory Per User	223
Demo Memory	224
Demo Streamlitand Memory	225
Extending Chatbot by Adding RAG	226
RAG with LangChain	227
Retrieval Augmented Generation (RAG) with LangChain	228
Read and Split Documents	229
Embed documents and store in the vector database	230
Retrieve documents and send as a context to the llm	231
Demo RAG -Indexing	232
Demo RAG – Retrieval and Generation	233
Extending Chatbot by Adding RAG + Memory	234
RAG Plus Memory	235
Adding chat history as context	236
Print of Response	237
Demo RAG Plus Memory and Tracing with LangSmith	238
Demo Evaluate Model using LangSmith	239
Recap Chatbot Architecture	240
Chatbot Technical Architecture	241

Deploy Chatbot to OCI Compute Instance	242
Deploy Chatbot to OCI Compute Instance (Virtual Machine)	243
Demo Deploy Chatbot to VM	244
Deploy Chatbot to OCI Data Science	245
Deploy LangChain Application to Data Science as Model	246