AI-900: Azure AI Fundamentals – Study Notes

Azure AI Services

├── Cognitive Services

│ ├── Vision

│ │ ├── Computer Vision

│ │ ├── Custom Vision

│ │ ├── Face API

│ │ └── Form Recognizer

│ ├── Speech

│ │ ├── Speech-to-Text

│ │ ├── Text-to-Speech

│ │ ├── Speech Translation

│ │ └── Speaker Recognition

│ ├── Language

│ │ ├── Text Analytics

│ │ ├── Translator

│ │ ├── LUIS (Intent Detection)

│ │ └── QnA Maker (merged into Language)

│ └── Decision

│ ├── Personalizer

│ ├── Anomaly Detector

│ └── Content Moderator

├── Azure Machine Learning

│ ├── Designer

│ ├── AutoML

│ ├── Notebooks

│ ├── Pipelines

│ ├── Model Registry

│ ├── Compute Targets

│ └── Deployment Endpoints

├── Azure OpenAI Service
│ ├── GPT-3.5 / GPT-4
│ ├── DALL·E
│ ├── Whisper
│ └── Embeddings
├── Azure AI Studio
│ ├── Prompt Flow
│ ├── Prompt Playground
│ ├── Model Catalog
│ ├── Data Grounding
│ ├── Fine-tuning
│ └── GenAI App Builder
└── Azure Bot Service (Conversational AI)
  ├── Bot Framework SDK
  ├── Channel Integrations
  ├── LUIS (from Language)
  └── QnA Integration

🏛 Top Level

◆ Azure AI Services *(Main category under Azure platform)*

Azure AI Services is the **umbrella category** that includes:

1. **Cognitive Services**
2. **Azure Machine Learning**
3. **Azure OpenAI Service**
4. **Azure AI Studio**
5. **Azure Bot Service (Conversational AI)**

◆ 1. Cognitive Services *(Pre-built AI models for perception and language)*

🧠 Categories under Cognitive Services:

Category	Services Under It	Notes
Vision	👁 Computer Vision, Custom Vision, Face API, Form Recognizer	Image understanding
Language	Text Analytics, Translator, Language Understanding (LUIS), QnA Maker*	NLP services
Speech	Speech-to-Text, Text-to-Speech, Speech Translation, Speaker Recognition	Speech processing
Decision	Personalizer, Anomaly Detector, Content Moderator	AI to make decisions
(Optional) Search	Bing Search APIs, Visual Search	Cognitive Search-based

📝 *Note: QnA Maker is now merged into Azure Language Service.*

◆ 2. Azure Machine Learning *(Custom model building & lifecycle management)*

□ Key Features under Azure Machine Learning:

Service	Purpose
Designer	Drag-and-drop ML model builder
AutoML	No-code model training for classification, regression
Notebooks	Jupyter-like Python environments
Pipelines	Automate ML workflow steps
Datasets / Data Labeling	Manage training data
Compute Targets	Scalable VMs for model training/inference
Model Registry	Version control and model tracking
Endpoints (Deployment)	Real-time or batch inferencing

◆ 3. Azure OpenAI Service *(Hosted Generative AI models)*

🤖 Models and Tools Available:

Model	Purpose
GPT-4, GPT-3.5	Text generation, chat, Q&A
DALL·E	Image generation
Whisper	Speech-to-text transcription
Embeddings	Semantic vector generation

◆ 4. Azure AI Studio *(Unified GUI for GenAI development)*

□ Services / Tools Inside Azure AI Studio:

Feature	Description
Prompt Flow	Visual workflow builder for LLM pipelines
Prompt Playground	Try and tune prompts
Model Catalog	Browse and deploy OpenAI + Hugging Face models
Data Grounding	Connect private data sources to make LLMs accurate
Fine-tuning Interface	Train foundation models on custom data
GenAI Studio Projects	Combine models, prompts, data, and evaluation in one app

🔔 *Think of this as your GenAI control center.*

◆ 5. Azure Bot Service (Conversational AI)

Feature	Description
Bot Framework SDK	Build bots with custom logic
Channels	Deploy on Teams, Web Chat, etc.
LUIS Integration	Add intent/intent recognition from Language service
QnA Maker / Azure Language	Add Q&A knowledge to bots

✅ This is **not a stand-alone Cognitive Service**, but **uses Language and QnA inside it**.

📸 Azure Cognitive Services – Vision Category

✅ Main Services Under Vision:

1. **Computer Vision**
2. **Custom Vision**
3. **Face API**
4. **Form Recognizer**
5. **OCR (part of Computer Vision)**

🔍 1. Computer Vision

🔧 What it does:

Pre-trained model that extracts visual data (objects, scenes, text) from images or videos.

🧠 Capabilities / Subfeatures:

Subfeature	Description	Keywords to Remember
Image Analysis	Detects objects, people, activities, and tags	"Tag objects," "Detect scenes," "Adult content"
OCR (Optical Character Recognition)	Extracts printed or handwritten text from images	"Text from image," "Read receipt," "Document text"
Read API (Advanced OCR)	Successor of OCR for more complex layouts like multi-column docs	"Read handwriting," "Read PDFs"
Spatial Analysis (Preview)	Tracks people movement in physical spaces	"Person presence," "Line crossing," "Retail analytics"
Thumbnail Generation	Automatically generates thumbnail from an image	"Smart cropping," "Auto thumbnail"
Image Description	Generates a human-readable caption	"Describe image," "Accessibility features"

◆ 1. Semantic Segmentation

Attribute	Value
Category	**Azure Cognitive Services → Vision**
Service	Part of **Custom Vision** or **advanced Computer Vision** models
What it does	Classifies **each pixel** in an image
Use Case	Image labeling at pixel level (e.g., identify roads, trees, sky in a satellite image)
Exam Hint	"Classify pixels by object" → **Semantic Segmentation** (not bounding box = Object Detection)

◆ 2. Specialized Domain Models in Computer Vision

Attribute	Value
Category	**Azure Cognitive Services → Vision → Computer Vision API**
Service	**Domain-specific pre-trained models**

Attribute	Value
Models	⭐ **Celebrities** (detect famous people), **Landmarks** (identify places)
Use Case	Media tagging, automatic labeling for photo apps, tourism platforms
Exam Hint	"Recognize a famous person in an image" → Computer Vision → **Celebrity Model**

📝 Exam Focus:

- When you **see terms like "extract objects," "generate captions," "analyze images"** — it's **Computer Vision**
- For **printed/handwritten text**, use **OCR / Read API**
- For **tracking movement**, think of **Spatial Analysis**
- For **scene description** and **tagging**, it's again **Computer Vision**

□ 2. Custom Vision

🔧 What it does:

You **train your own model** to recognize specific objects or categories in images.

🧠 Capabilities:

Capability	Description	Keywords to Remember
Image Classification	Classifies images into tags or labels	"Classify dog breeds," "Label as safe/unsafe"
Object Detection	Detects object **location** within an image	"Draw bounding box," "Locate specific part"
Training & Iteration	Upload images and label them for training	"Model training," "Custom labels," "Image upload"
Model Export	Export model to run offline (e.g., mobile devices)	"Edge deployment," "ONNX," "Offline inference"

📝 Exam Focus:

- If question says **"custom image tags," "train with labeled images," "identify unique parts"** – answer is **Custom Vision**
- For "download model and run locally," **Custom Vision supports model export**

☺ 3. Face API

🔧 What it does:

Detects and analyzes human faces in images.

🧠 Capabilities:

Feature	Description	Keywords
Face Detection	Detects presence of faces	“Bounding box,” “Face presence”
Facial Analysis	Estimates age, gender, emotion, facial landmarks	“Emotion detection,” “Age estimation”
Face Verification	Compares two faces to check if same person	“Match faces,” “Face login”
Face Identification	Identify a person from a known group	“Person group,” “Face recognition database”

📝 Exam Focus:

- When the question talks about **"identify people", "verify identity", "emotion analysis"** — go with **Face API**

□ 4. Form Recognizer

🔧 What it does:

Extracts structured data from forms, receipts, invoices, and IDs.

🧠 Capabilities:

Subservice	Description	Keywords
Prebuilt Models	Works out-of-the-box for receipts, invoices, business cards	“Read receipts,” “Expense automation”
Custom Form Models	Train model to extract data from custom layouts	“Train form layout,” “Custom templates”
Layout API	Detects tables, lines, and key-value pairs	“Detect structure,” “Document zones”

📝 Exam Focus:

- If question mentions **“extract fields from receipts,” “process business cards,” “read ID docs”**, choose **Form Recognizer**

🎓 AI-900 EXAM STRATEGY SUMMARY (VISION)

Scenario / Keyword	Pick This Service
“Extract objects or tags from an image”	Computer Vision
“Train model to recognize dog breeds”	Custom Vision
“Get person age, emotion, face match”	Face API
“Read scanned invoice, extract name/amount”	Form Recognizer
“Detect movement in a store”	Computer Vision (Spatial Analysis)
“Read handwritten text in a letter”	Computer Vision (Read API)

🔊 Azure Cognitive Services – Speech

✅ Main Services:

1. **Speech to Text**
2. **Text to Speech**
3. **Speech Translation**
4. **Speaker Recognition**

1️⃣ Speech to Text

What it does: Converts spoken audio into written text.

Feature	Description	Keywords
Real-time & Batch	Converts live speech or audio files to text	"Transcribe audio," "Voice to text"
Punctuation & Formatting	Adds punctuation automatically	"Clean transcripts"
Custom Speech	Tailor speech recognition to your domain	"Custom vocabulary," "Industry-specific words"

📝 Exam Tip:
If a question says “transcribe meetings” or “convert voice note to text,” → **Speech to Text**.

2️⃣ Text to Speech

What it does: Converts text into spoken audio (natural-sounding voices).

Feature	Description	Keywords
Neural Voices	Human-like voices	"Read article out loud," "IVR response"
SSML Support	Control pitch, rate, emotion	"Speech synthesis markup language"
Custom Voice	Train your own voice model	"Brand voice," "Voice customization"

📝 **Exam Tip:**
Look for “voice response,” “audio playback from text,” → **Text to Speech**.

---

3 $peech Translation

What it does: Translates **spoken language** to another language in real-time.

Feature	Description	Keywords
Real-time	Listen → Translate → Speak	“Translate while speaking,” “Multilingual meetings”
Multiple Languages	Support for 60+ languages	"Global conversations"

📝 **Exam Tip:**
“User speaks French, receives English output” → **Speech Translation**

---

4 $peaker Recognition

What it does: Identifies **who** is speaking using voiceprint.

Mode	Description	Keywords
Verification	Is this person who they claim to be?	"Voice-based login"
Identification	Who is speaking among known users?	"Detect from voice group"

📝 **Exam Tip:**
“Recognize employee by voice,” “Secure voice login” → **Speaker Recognition**

🗣 Azure Cognitive Services – Language

✅ Main Services:

1. **Text Analytics**
2. **Language Understanding (LUIS)** — being replaced by **Conversational Language Understanding**

3. **Translator**
4. **QnA Maker** (now part of **Azure AI Language**)

1️⃣ Text Analytics

What it does: Extracts insights from raw text.

Feature	Description	Keywords
Sentiment Analysis	Positive, Negative, Neutral	"Mood from feedback"
Key Phrase Extraction	Pulls out main topics	"Main ideas," "Text summary"
Named Entity Recognition (NER)	Finds people, places, orgs	"Entity detection"
Language Detection	Detects language of input	"Auto-language detect"
PII Detection	Identifies sensitive info	"Mask phone/email," "Data privacy"

📝 **Exam Tip:**
"Analyze user reviews," "detect customer mood," "extract email from feedback" → **Text Analytics**

2️⃣ Language Understanding (LUIS) *(Legacy, but exam-relevant)*

What it does: Understands user intent from natural language.

Feature	Description	Keywords
Intents	What the user wants to do	"Book flight," "Get weather"
Entities	Important data in sentence	"Date," "Location"
Utterances	Examples of phrases	"Train model," "Understand input"

📝 **Exam Tip:**
"User says 'Show me flights to Mumbai' → extract intent + city" → **LUIS**

3️⃣ Translator

What it does: Real-time text translation between 90+ languages.

Feature	Description	Keywords
Dynamic Translation	Live translation of user input	"Multi-language chatbot"

Feature	Description	Keywords
Multiple Language Pairs	Text input & translated output	"Text translation API"

📝 **Exam Tip:**
"User sends message in Hindi, sees reply in English" → **Translator**

---

4 QnA Maker *(Merged into Azure AI Language)*

What it does: Converts documents or FAQs into a question-answer bot.

Feature	Description	Keywords
Knowledge Base	Upload files, URLs to auto-generate Q&A	"FAQ bot," "Instant knowledge"
Multi-turn Dialogues	Follow-up questions support	"Interactive Q&A"
Customizable Responses	Edit answers manually	"Control over answers"

📝 **Exam Tip:**
"Want to make FAQ chatbot from PDF" → **QnA Maker** / **Azure AI Language (Q&A)**

1 Natural Language Processing (NLP) Subtasks

PDF mentions the following NLP-specific capabilities under Language Cognitive Services:

- **Key phrase extraction**
- **Entity recognition (NER)** – e.g., detecting names, companies, locations
- **Language detection**
- **Sentiment analysis**
- **Document categorization**

➞ These are all part of **Text Analytics API**, so you should:

- Recognize which task uses which NLP service
- Understand their use cases (e.g., extract names = NER; detect tone = Sentiment)

---

2. Form Recognizer vs OCR

- **OCR**: From **Computer Vision** – extracts raw printed or handwritten text
- **Form Recognizer**: Structured extraction (key-value pairs, tables) from forms/invoices
- **Exam questions may ask you to pick the right one** for documents, forms, receipts

➞ Know the difference for the following question pattern:

“Which service extracts structured data from scanned tax forms?”
✓ **Answer**: Form Recognizer

---

3. Entity Recognition

- It’s a named NLP capability and comes up in multiple questions
- Useful for questions like:

“Which service identifies names of companies and people in text?”
✓ **Answer**: Named Entity Recognition

---

4. QnA Maker Content Types

PDF mentions this in detail:

- Supported formats: `.txt`, `.docx`, `.pdf`, `.tsv`
- NOT supported: `.pptx`, `.xml`

➞ Exam question may test you on what formats QnA Maker can ingest

---

5. AI Workload Matching

PDF repeatedly uses **drag-drop questions** asking you to match scenarios to workload types:

- Use NLP for: detect language, extract key phrases
- Use Computer Vision for: recognize faces, analyze images
- Use Knowledge Mining for: make PDFs searchable
- Use Conversational AI for: chatbot answering questions

➞ Ensure you're comfortable with these matches

Neural Machine Translation (NMT)

Attribute	Value
Category	**Azure Cognitive Services → Language**
Service	**Azure Translator (Text Translation API)**
Model Used	**✓ Neural Machine Translation (NMT)**

Attribute	Value
Use Case	Translate text across 90+ languages
Exam Hint	“Translate text using neural model” → Azure Translator → **NMT**

🤖 Azure Cognitive Services – Decision

✅ Main Services:

1. **Personalizer**
2. **Content Moderator**
3. **Anomaly Detector** *(Less emphasized in AI-900, but may appear)*

1️⃣ Personalizer

What it does: Provides real-time personalized content or actions.

Feature	Description	Keywords
Contextual Recommendations	Learns from feedback (reinforcement learning)	"Suggests next item," "Optimizes newsfeed"
Rank API	Ranks items based on preferences	"Best item for user"

📝 Exam Tip:
“Suggest article for user,” “personalize product display” → **Personalizer**

2️⃣ Content Moderator

What it does: Filters offensive or inappropriate content.

Feature	Description	Keywords
Text Moderation	Flags profane or abusive words	"Inappropriate language"
Image Moderation	Detects adult/racy content	"Image filter"
Custom Lists	Add your own banned words	"Custom terms"

📝 Exam Tip:
“Detect hate speech,” “filter uploaded images” → **Content Moderator**

3️⃣ Anomaly Detector *(Low-weight for AI-900 but still notable)*

What it does: Detects abnormal patterns in time-series data.

Feature	Description	Keywords
Time-Series Input	Analyzes temperature, sales, etc.	"Unexpected dip or spike"
Unsupervised Learning	Doesn't need labels	"Sensor data," "Real-time alerts"

📝 **Exam Tip:**
"Monitor data from IoT device for failure" → **Anomaly Detector**

✅ Summary Cheat Table (AI-900 Key Mapping)

Scenario / Keyword	Choose This Service
Convert audio to text	Speech to Text
Convert text to audio	Text to Speech
Translate spoken language	Speech Translation
Verify person by voice	Speaker Recognition
Understand intent (chatbot)	LUIS
Translate text in real-time	Translator
Detect sentiment/emotions in reviews	Text Analytics
Create FAQ bot from documents	QnA Maker
Recommend products	Personalizer
Filter bad words or adult content	Content Moderator

🧠🔍 Supervised vs. Unsupervised Learning – Cheat Notes for AI-900 + Interview

---

✅ 1. Supervised Learning

📌 **Definition:**
You train a model using **labeled data** (data with correct answers).

📌 **Use Cases:**

- **Classification**
- **Regression**

🔹 *A. Classification*

📌 What it does:
Predicts a **category/label** (e.g., Yes/No, Spam/Not Spam, Class A/B/C).

🧠 Keywords to Remember:

- "Yes or No"
- "Spam or Not"
- "True or False"
- "Disease A, B, or C"
- "Customer churn: Will Leave or Stay"
- "Email type: Promotions, Primary, Social"

📝 Exam Questions Might Say:

- "What type of ML is used to classify emails?"
- "Predict if a loan will default: Supervised or Unsupervised?"
  → **Answer:** Supervised - Classification

🔹 *B. Regression*

📌 What it does:
Predicts a **numeric/continuous value** (e.g., price, age, temperature).

🧠 Keywords to Remember:

- "Predict salary"
- "Estimate house price"
- "Forecast temperature"
- "How much revenue"
- "Demand prediction"

Regression Types: Ordinal & Poisson

Attribute	Value
Category	**Azure Machine Learning → AutoML or Designer**
Tool	**AutoML** supports both; **Designer** supports as part of regression models
Ordinal Regression	Predict ranked categories (e.g. 1–5 star ratings)

Attribute	Value
Poisson Regression	Predict **counts** (e.g. number of calls per hour)
Exam Hint	"Predict rating score" → **Ordinal**; "Predict call volume" → **Poisson**

📝 Exam Questions Might Say:

- "Predict sales next month: Which ML technique?"
  ➜ **Answer:** Supervised - Regression

✅ 2. Unsupervised Learning

📌 Definition:
Model works with **unlabeled data** to find patterns or groupings.

📌 Use Cases:

- **Clustering**
- **Dimensionality Reduction** *(advanced, not common in AI-900)*

🔹 *A. Clustering*

📌 What it does:
Groups similar data points **without knowing the labels**.

🧠 Keywords to Remember:

- "Customer segmentation"
- "Group users by behavior"
- "Find patterns in purchases"
- "No labeled output"
- "Anomaly detection" (sometimes)

Clustering Model Metrics

Attribute	Value
Category	**Azure Machine Learning → Model Evaluation for Clustering**
Model Type	**Unsupervised ML**

📝 Exam Questions Might Say:

- "Segment customers based on usage data"
  ➜ **Answer:** Unsupervised - Clustering

🔁 Quick Memory Table:

Scenario / Goal	Type	Learning Type	Keywords
Predict price of a house	Regression	Supervised	"Estimate," "Numeric value"
Predict if a student passes/fails	Classification	Supervised	"Yes/No," "True/False," "Labels"
Group customers by behavior	Clustering	Unsupervised	"Group," "Segmentation," "No labels"
Predict product demand next month	Regression	Supervised	"Forecast," "How much"
Classify photos into cats/dogs	Classification	Supervised	"Image label," "Is it a dog?"
Detect unusual network activity	Clustering	Unsupervised	"Anomaly," "Unusual pattern"

🧠 Interview & Exam Tip Keywords

Concept	Keywords	Examples
Supervised Learning	**Labeled data, prediction, known output**	Regression, Classification
Unsupervised Learning	**Unlabeled data, patterns, grouping**	Clustering
Regression	**Numbers, price, forecast, quantity**	Predict sales
Classification	**Yes/No, label, category**	Spam detection
Clustering	**Segment, group, similar behavior**	Group customers
Anomaly Detection	**Unusual, outlier, unexpected**	Fraud detection

---

🎯 AI-900 Exam Style Question Examples

1. **"What type of ML technique is used when predicting housing prices?"**
   ➜ Regression (Supervised)
2. **"Which type of learning uses unlabeled data to group data into similar clusters?"**
   ➜ Clustering (Unsupervised)
3. **"Identify whether a customer will renew their subscription or not."**
   ➜ Classification (Supervised)
4. **"Group shopping behavior without predefined labels."**
   ➜ Clustering (Unsupervised)
5. **"Forecast the number of calls to a call center."**
   ➜ Regression (Supervised)

🎓 Features vs. Labels – AI-900 Exam Point of View

✅ What are Features?

- **Inputs** to the model.
- These are the **characteristics or attributes** used to make a prediction.

🧠 **Keywords:**
"Inputs", "Independent Variables", "What we know", "Used to predict"

📌 **Examples:**

- Age, income, city, education level
- Image pixels (for image models)
- Text content (for sentiment models)

✅ What are Labels?

- **Outputs** the model learns to predict.
- The **answer** you are training the model to produce.

🧠 **Keywords:**
"Target", "Ground truth", "What we want to predict", "Dependent variable"

📌 **Examples:**

- Will the customer churn? → **Yes/No**
- What is the house price? → **$250,000**
- Sentiment of review? → **Positive**

🧠 When Do You Need Features and Labels?

Scenario Type	Features	Labels	Example
Supervised Learning	✅ Required	✅ Required	Predict price of a house
Unsupervised Learning	✅ Required	❌ Not used	Group customers by behavior
Model Training Phase	✅ Required	✅ Required (for supervised)	Teach model with data
Prediction/Inference Phase	✅ Required	❌ Not needed	Model already knows how to predict
Clustering (Unsupervised)	✅ Required	❌ Not used	No known output, just find structure
Classification / Regression	✅ Required	✅ Required	Labeled training needed
Text Analytics (like sentiment analysis)	✅ Required	✅ Required (during training)	Train with reviews and sentiment

---

🎯 AI-900 Style Exam Question Scenarios

1. **"You want to predict customer churn using historical data. What do you need?"**
   ✅ Features: Customer age, usage history
   ✅ Labels: Whether they churned
   ➜ **Supervised Learning (Features + Labels)**
2. **"You want to group customers into segments based on buying habits. What do you need?"**
   ✅ Features: Purchase behavior
   ❌ No labels (no right answer)
   ➜ **Unsupervised Learning (Features only)**
3. **"Which type of data is the model trying to predict in supervised learning?"**
   ➜ **Label**
4. **"Which part of the data contains input variables used by the model?"**
   ➜ **Features**
5. **"In a trained classification model, you input new customer data. What's not needed now?"**
   ➜ **Label** (You are now in prediction phase)

□ Simple Visual Analogy:

Training data = Features + Labels
(e.g., [Age, Salary] → [Will Leave? Yes/No])

Unsupervised data = Features only
(e.g., [Spending, Browsing time] → No known output, just group patterns)

🧠 Keywords to Remember:

Concept	Keyword Clues
Features	"Input", "Predictor", "Attribute", "Known info"
Labels	"Output", "Target", "What to predict", "Ground truth"
Supervised	**Needs Features + Labels**
Unsupervised	**Only Features**
Inference (after model is trained)	**Only Features** (model predicts the label)

🤖🛞 Responsible AI – Core Principles & Exam Keywords

✅ 1. Fairness

📌 Meaning:
AI should **treat all users equally** and not favor one group over another.

🧠 Keywords for Exam:

- “Avoid bias”
- “Equal treatment”
- “Non-discrimination”
- “No favoritism”
- “Bias in data or model”

📝 Sample Question Clue:

“An AI model is giving better results for men than women. What principle is violated?”
Answer: Fairness

✅ 2. Inclusiveness

📌 Meaning:
AI should be **usable and beneficial to everyone**, including people from diverse backgrounds or with disabilities.

🧠 **Keywords for Exam:**

- “Accessible”
- “Diverse needs”
- “Support disabilities”
- “Everyone can use”
- “Cultural or language inclusion”

📝 **Sample Question Clue:**

“An AI tool must support people with visual impairments. Which principle?”
Answer: Inclusiveness

✅ 3. Reliability and Safety

📌 **Meaning:**
AI systems must **work as intended** and **fail safely** under uncertain conditions.

🧠 **Keywords for Exam:**

- “Consistent output”
- “Avoid failure”
- “Safe behavior”
- “Test before deploy”
- “Resilience”

📝 **Sample Question Clue:**

“What principle ensures AI behaves correctly even in edge cases?”
Answer: Reliability and Safety

✅ 4. Transparency

📌 **Meaning:**
AI decisions must be **understandable**, and users should know **how and why** a decision was made.

🧠 **Keywords for Exam:**

- “Explainable AI”
- “Understand the model’s reasoning”
- “Open about use of AI”
- “Human oversight”

📝 **Sample Question Clue:**

"What principle helps users understand how the AI came to a conclusion?"
Answer: Transparency

✅ 5. Accountability

📌 **Meaning:**
Humans must be held **responsible** for AI actions and decisions.

🧠 **Keywords for Exam:**

- "Human oversight"
- "Owner responsible"
- "Ethical AI use"
- "Review AI decisions"

📝 **Sample Question Clue:**

"Who is accountable when an AI system causes harm?"
Answer: The organization/person that deployed it – **Accountability**

✅ 6. Privacy and Security

📌 **Meaning:**
Protect user data and maintain **data confidentiality and integrity** in AI systems.

🧠 **Keywords for Exam:**

- "Data protection"
- "GDPR compliance"
- "Encrypt personal data"
- "Do not misuse user info"

📝 **Sample Question Clue:**

"What principle ensures AI does not expose personal data?"
Answer: Privacy and Security

🎯 Cheat Table for Quick Revision

Principle	Exam Focus Keywords
Fairness	Bias-free, non-discriminatory, equal treatment
Inclusiveness	Accessibility, diversity, disabilities, cultural support
Reliability & Safety	Consistent, works under all conditions, tested
Transparency	Explainable, visible logic, clear how decisions made
Accountability	Human responsible, traceable, ethical oversight
Privacy & Security	Secure data, confidential info, compliance

---

🧠 Extra Exam Tips:

- If the question talks about **bias in dataset/model**, it's about **Fairness**.
- If it mentions **AI system works better for one group**, it's **Unfair**.
- If it's about **clear explanations**, that's **Transparency**.
- **Inclusiveness** = "Help people with disabilities" or "Support multiple languages."
- **Accountability** is always about **who is responsible** (Hint: Always the human).
- **Privacy** questions often mention **personal data**, **regulations**, or **encryption**.

🧠 AZURE MACHINE LEARNING – Exam-Focused Breakdown

✅ Azure Machine Learning (AML) is all about creating custom ML solutions using your own data.

◆ Core Components Under Azure Machine Learning

Feature / Tool	Purpose	Keywords for Exam
ML Studio / AML Workspace	Central hub to manage experiments, models, data	"Central place", "Manage assets", "ML workspace"
ML Designer	Drag-and-drop tool to visually build ML pipelines	"No code", "Visual", "Supervised/unsupervised"
AutoML (Automated ML)	Automatically selects the best model and hyperparameters	"No data science skill needed", "Automatic algorithm selection"
Notebooks	Write custom Python code (Jupyter interface)	"Python", "Code-first", "Data scientist-friendly"
Pipelines	Automate end-to-end workflows (data prep → training → deployment)	"Repeatable ML", "Automation", "Reproducible"

Feature / Tool	Purpose	Keywords for Exam
Model Registry	Store and version ML models	"Track versions", "Reuse models"
Endpoints	Deploy trained model as REST API	"Real-time inference", "HTTP endpoint", "Consume via apps"
Datasets	Upload and manage data sources	"Data source management", "Reusable datasets"
Compute Targets	Virtual machines/clusters for training	"GPU/CPU machines", "Scale training"
Environments	Define dependencies and packages	"Reusable setup", "Consistent training environment"

📌 AI-900 Focused Service Types Within AML

Category	Tool	What It's For
No-code ML	ML Designer	Visual drag-drop pipelines
Low-code ML	AutoML	Auto-select model/algorithm
Code-first ML	Notebooks, SDK	Python/R-based advanced usage
Deployment	Endpoints, Model Registry	Making models available as APIs
Data Handling	Datasets	Uploading, managing data
Infrastructure	Compute Targets	Where training happens (VMs)

📝 Common AI-900 Exam Question Patterns

1. "Which Azure ML tool lets you build models without writing code?"

✅ **Answer:** ML Designer
Keyword clue: drag and drop, visual

---

2. "Which feature automatically selects the best algorithm?"

✅ **Answer:** AutoML
Keyword clue: no ML expertise, automation, best model

---

3. "You want to deploy a trained model as an API. What feature should you use?"

✅ **Answer:** Endpoint (or Real-time inference endpoint)

---

4. "What is used to track versions of models for deployment?"

✅ **Answer:** Model Registry

---

5. "You want to automate retraining your model every month. What feature helps?"

✅ **Answer:** Pipelines

🎯 Key Terms to Remember for Exam

Term	Meaning
AML Workspace	Central control panel
Designer	Visual ML tool
AutoML	Auto-select algorithm & hyperparameters
Notebook	Python coding environment
Pipeline	Reusable/automated training steps
Endpoint	Expose model as API
Model Registry	Store versioned models
Compute Target	Where model training runs (VMs)
Environment	Training setup/config

👀 Bonus: Match These to Real-World Scenarios (Exam Style)

Scenario	Tool
Build ML model without coding	**Designer**
Quickly train model using automation	**AutoML**
Track all model versions for governance	**Model Registry**
Train model using GPU VM	**Compute Target**
Expose model for real-time prediction	**Endpoint**
Automate steps from data cleaning to training	**Pipelines**
Use Python to experiment with model code	**Notebook**

🧠 Azure ML Workflow Steps – AI-900 Focused View

Below is the typical order in a machine learning workflow, with **exam-oriented concepts, keywords**, and **what you need to remember**.

✅ 1. Data Collection / Data Input

- **Purpose**: Get data from CSV, SQL, Blob, etc.
- **Tools**: AML Datasets, Designer Data Input modules
- **Exam Keywords**:
  - "Load data"
  - "Import data from storage"
  - "CSV, blob, database"

✅ 2. Data Splitting

- **Purpose**: Split data into **Training** and **Testing** datasets (e.g. 70/30 or 80/20)
- **Tools**: *Split Data* module in Designer
- **Exam Keywords**:
  - "Train/test split"
  - "Separate for evaluation"
  - "Avoid overfitting"

✅ 3. Data Preprocessing (Cleaning)

- **Purpose**: Clean or prepare the data (remove nulls, normalize, handle missing values)

- **Tools**: *Clean Missing Data*, *Normalize Data*, *Edit Metadata*
- **Exam Keywords**:
  - "Remove nulls"
  - "Normalize data"
  - "Handle missing values"
  - "Encode categorical values"

✅ 4. Feature Engineering & Feature Selection

🔷 These are **very commonly asked** in AI-900 exams. Let's break them down.

🧠 *Feature Engineering*

- **Purpose**: Create or transform input variables (features) to improve model performance.
- **Examples**:
  - Combine date columns
  - Extract day/month from timestamp
  - Encode text into numbers (e.g. One Hot Encoding)
- **Exam Keywords**:
  - "New column from existing data"
  - "Transform input variables"
  - "Text to numeric"
  - "Feature creation"

🎯 *Feature Selection*

- **Purpose**: Choose the **most relevant input variables** for training.
- **Why?** Too many irrelevant features → poor performance or overfitting.
- **Tools**: *Select Columns in Dataset*, *Filter-based Feature Selection*
- **Exam Keywords**:
  - "Select most impactful inputs"
  - "Reduce noise"
  - "Improve model accuracy"

✅ 5. Model Training

- **Purpose**: Feed training data into an algorithm (like Decision Tree, Logistic Regression)
- **Tools**: *Train Model* module
- **Exam Keywords**:
  - "Train algorithm"

- "Fit model to data"
- "Use labels (for supervised)"

✅ 6. Model Evaluation

- **Purpose**: Test model's performance using **testing dataset**
- **Metrics to Remember**:
  - **Classification**: Accuracy, Precision, Recall, F1 Score
  - **Regression**: RMSE, MAE, R^2
- **Tools**: *Evaluate Model* module
- **Exam Keywords**:
  - "Confusion matrix"
  - "Error metrics"
  - "Compare model accuracy"

✅ 7. Model Deployment (Not in this topic but next step)

- Make it available via endpoint (only relevant if asked about complete pipeline)

🔄 Summary – ML Pipeline for AI-900 (Cheat Sheet Format)

Step	What You Do	Exam Tip
Data Input	Import data into Azure ML	From blob, SQL, CSV
Data Splitting	Train/Test (e.g. 70/30)	Avoid overfitting
Preprocessing	Clean/normalize/fix nulls	Handle missing data
Feature Engineering	Create new useful inputs	e.g. extract year, encode gender
Feature Selection	Pick most important features	Improve performance
Training	Fit model to training data	Algorithm + labels
Evaluation	Check how well model performs	Metrics depend on model type

---

📌 Sample AI-900 Exam Question Patterns

Q1: What step in the ML pipeline includes transforming input data into a more useful format?
☞ **Answer:** Feature Engineering

Q2: You split your data into 80% training and 20% testing. What step is this?
☞ **Answer:** Data Splitting

Q3: Which metric would you use to evaluate a regression model?
☞ **Answer:** RMSE (Root Mean Squared Error)

Q4: Why is feature selection important?

☞ **Answer:** It improves performance and reduces overfitting.

◆ Conversational AI and Azure Bot Service

🔑 Does it come under Cognitive Services?

✅ **YES** — **Conversational AI** is **powered by Azure Bot Service**, which uses **Cognitive Services** (like **Language Understanding** or LUIS)

From **exam point of view**, it's **part of Azure AI services**, leveraging multiple Cognitive Services underneath.

🎯 Conversational AI in AI-900 Exam – What You Need to Know

Topic	Exam Keywords / Tips
Azure Bot Service	Build, test, deploy conversational interfaces (bots)
Bot Framework	Toolset for creating dialog flows (Q&A, commands, multi-turn)
Integration	Can connect with Cognitive Services like **LUIS** (for understanding intent)
Multi-channel	Bots can run on MS Teams, Web Chat, WhatsApp, etc.
Use Case	Customer support chatbot, helpdesk, feedback bots

✅ **Remember**:

"Conversational AI is **not a single Cognitive Service**, but an integration using Azure Bot Service + Cognitive Services (like Language Understanding)."

◆ Azure AI Studio – New Platform (Important in 2024/2025 Exams)

🔑 Where does Azure AI Studio come in?

✅ **Azure AI Studio** is part of the **Azure AI Services umbrella**, but more focused on **Generative AI and LLMs**.

🎯 Azure AI Studio – Exam View

Feature	What It Does	Keywords to Remember
Central AI Hub	Unified UI for building AI solutions	"No-code/low-code interface"
Prompt Flow	Design/test prompt-based workflows for LLMs	"Prompt testing", "LLM pipeline"
Chat Playground	Try chat-based interactions with OpenAI models	"Generative AI", "GPT models"
Fine-tuning	Train models with your own data	"Customize foundation models"
Model Catalog	Browse models like GPT-4, Whisper, DALL·E	"Foundation model discovery"
Data Connections	Bring in your own data sources	"Grounded LLM responses"

✅ Azure AI Studio Helps You With:

Use Case	Tools Involved
Build custom LLM chatbot	Prompt Flow, OpenAI models
Fine-tune GPT with private data	Fine-tuning in AI Studio
Evaluate and deploy GenAI workflows	Evaluation + endpoint integration
Try few-shot/zero-shot prompting	Prompt playground

📝 Exam Tips for Azure AI Studio:

- It is **NOT part of Cognitive Services**, but sits under **Azure AI platform**.
- It works **with Azure OpenAI Service** (which gives access to GPT, DALL·E, Whisper, etc.)
- Useful for **enterprise-grade GenAI apps**, **not classical ML**.
- **Prompt Flow** is a key term that might appear as MCQ (prompt → model → evaluation → output)

🧠 Summary Table – What Comes Under What?

Category	Comes Under	Keywords
Cognitive Services	Azure AI Service	Vision, Language, Speech, Decision
Conversational AI	Azure AI (using Bot Service + LUIS from Cognitive Services)	Bots, dialogs, intents
Azure Machine Learning	Azure AI Service	AutoML, Designer, Training, Deployment
Azure AI Studio	Azure AI (new GenAI experience)	LLMs, Prompt Flow, Fine-tune

📚 What Is a Knowledge Mining Workload?

✅ Definition:

Knowledge mining is the process of using AI to **extract structured information** from **unstructured or semi-structured data** like PDFs, images, documents, emails, etc.

Think of it as **turning raw content into searchable insights** using AI.

🧠 Where Does It Fit in Azure AI?

🔑 It comes under:

✅ Azure AI Services → Cognitive Services + Azure Cognitive Search

So, in the **exam hierarchy**, place it like this:

```
scss
CopyEdit
Azure AI Services
├── Cognitive Services
│    ├── Vision (Form Recognizer)
│    ├── Language
│    └── Decision
└── Knowledge Mining Workload (uses multiple AI services + Azure Cognitive Search)
```

It is a **workload type**, not a specific service like "Form Recognizer" or "Text Analytics".

□ Tools Used in Knowledge Mining

Tool / Service	Purpose
Azure Cognitive Search	Makes content searchable
Form Recognizer	Extracts key-value pairs and tables from forms, invoices, PDFs
Text Analytics	Extracts sentiment, key phrases, entities
OCR (via Computer Vision)	Reads text from scanned images
Custom Skills / Enrichment Pipeline	Adds domain-specific logic (optional)

🎯 AI-900 Exam Focus: When They Ask About Knowledge Mining

📌 Common Keywords to Watch For:

- "Extract data from scanned documents"
- "Make PDFs searchable"
- "Enrich unstructured data"
- "Build intelligent search over enterprise content"
- "AI + search to find insights"

📝 Sample Question:

You have thousands of PDFs and images with customer contracts. You want to extract names, dates, and amounts and make them searchable.
Which Azure AI workload should you use?
✅ **Answer:** Knowledge Mining

🔄 Summary Cheat Sheet

Concept	Knowledge Mining
Type	Workload under Azure AI
Uses	OCR, Form Recognizer, Text Analytics, Azure Cognitive Search
Input	Unstructured data (PDFs, forms, emails, images)
Output	Structured, searchable, enriched data
Real-world use	Legal docs, resumes, contracts, invoices

✅ 2. Anomaly Detection

◆ Where It Fits:

- ✅ **Azure AI Services → Cognitive Services → Decision category**
- Service: **Anomaly Detector**

📌 Use Case:

- Detect **unusual patterns** in **time series data** (e.g., temperature, transactions, server metrics)

🔍 Exam Keywords:

- "Unexpected spike/drop in data"
- "Monitor sensor data"
- "Detect abnormal behavior"
- "Time-series analysis"

💡 Model Type:

- ✅ **Unsupervised** (no labels)
- Sometimes **semi-supervised** (learns from historical normal data)

📝 Example Question:

"Which Azure service would you use to detect abnormal server CPU usage over time?"
✅ **Answer:** Anomaly Detector (Cognitive Services → Decision)

✅ 3. Classification Metrics

◆ Where It Fits:

- ✅ **Azure Machine Learning → Model Evaluation Phase**
- Applies to **classification models** (Supervised ML)

📌 Metrics to Know:

Metric	Meaning	Tip
Accuracy	Overall correct predictions / total	Good for balanced data
Precision	TP / (TP + FP)	"How many predicted Positives were correct?"
Recall	TP / (TP + FN)	"Did we find all actual Positives?"
F1 Score	Harmonic mean of Precision & Recall	Best when class distribution is imbalanced
AUC (ROC)	Area under ROC curve	Measures ability to separate classes

Metric	Meaning	Tip
True Positive Rate	Same as Recall	Watch for synonym use in exam

📝 Example Question:

"Which metric is best for a cancer test where False Negatives must be minimized?"
✅ **Answer: Recall**

✅ 4. Deployment Concepts

🔷 Where It Fits:

- ✅ **Azure Machine Learning → Model Deployment Phase**

📌 Exam Points:

Term	Explanation
Real-time Endpoint	Expose model via HTTP API
REST Endpoint + Key	Use in apps to call predictions
AKS (Azure Kubernetes Service)	Scalable compute for high-load deployments
Batch Inference	Use when real-time is not needed (e.g., daily predictions)

📝 Example Question:

"You want to expose a trained model as an API. What should you use?"
✅ **Answer:** Real-time Endpoint

✅ 5. Data Labeling

🔷 Where It Fits:

- ✅ **Azure Machine Learning → Before Model Training (Supervised Learning)**

📌 When It's Used:

- Needed for **Supervised Learning**
- You must tag inputs with correct outputs (labels)

- In **Designer**, used when preparing datasets for classification

📝 Example Question:

"You have images and want to train a classifier. What must you provide first?"
✅ **Answer:** Labels (Data Labeling)

✅ 6. Validation vs. Test Set

🔷 Where It Fits:

- ✅ **Model Evaluation / Training Phase in Azure Machine Learning**

📌 Key Differences:

Term	Purpose	Tip
Validation Set	Tune model, select hyperparameters	Used during training
Test Set	Final evaluation after model is trained	Never used for tuning

📝 Example Question:

"Which data subset is used for fine-tuning a model's performance during training?"
✅ **Answer:** Validation Set

"Which data is only used once to assess final performance?"
✅ **Answer:** Test Set

✅ 7. AutoML Behavior

🔷 Where It Fits:

- ✅ **Azure Machine Learning → AutoML (Automated ML)**

📌 What It Does:

Behavior	Explanation
Iterates algorithms	Tries multiple models (e.g., Decision Tree, SVM, etc.)
Tunes parameters	Adjusts learning rate, depth, etc.
Stops on scoring metric	Early stopping when best score found
Supports multiple tasks	Classification, Regression, Forecasting

📝 Example Question:

“Which tool in Azure ML automatically finds the best model and hyperparameters?”
✅ **Answer:** AutoML

“AutoML was used to predict housing prices. What type of ML task is this?”
✅ **Answer:** Regression

✅ Summary Table (AI-900 Exam Angle)

Topic	Belongs To	Must-Know Exam Points
Anomaly Detection	Cognitive Services → Decision	Time series, unsupervised
Classification Metrics	Azure ML – Model Evaluation	Accuracy, Precision, Recall, F1, AUC
Deployment Concepts	Azure ML – Deployment Phase	REST API, AKS, Endpoint
Data Labeling	Azure ML – Data Prep	Required for Supervised Learning
Validation vs. Test	Azure ML – Train/Eval Phase	Validation = tuning, Test = final check
AutoML Behavior	Azure ML – AutoML Tool	Tries multiple models, stops on metric