Azure AI-900 Artificial Intelligence (AI) Cheat sheet v2024.09.21

Guiding principles FRAUPIT

- **Accountability** – People should be accountable for AI systems
- **Inclusivity** – Empower everyone and Engage people
- **Transparency** – Understandable decisions
- **Privacy & Security** – Be secure and respect privacy
- **Fairness** – Treat all people fairly
- **Reliability** – Perform reliably and Safely
- **Unintended Consequences** – Bias, Wrong, Illegal, Hallucinations, Harmful

Seeing AI

AI Fairness Checklist

Common Workloads

- **Anomaly Detection** – Is this weird?
- **Content Moderation** – Violence, Self-Harm, Sexual, Hate
- **Prediction & Forecasting**
- **Computer Vision**
- **Knowledge Mining** – AI S/W Navigator
- **Natural Language Processing (NLP)** – What info is in? – AI S/W Sentinel

Vision Workloads

- **Facial detection & recognition**
- **Optical Character Recognition** – Detect text
- **Image Classification** – What is image? A car!
- **Semantic Segmentation** – Detect object boundaries
- **Object Detection** – Detect multiple objects on image
- Tools

NLP Workloads

Understand written or spoken language

- **Key Phrase Extraction** – Key points in document
- **Speech Recognition & Synthesis** – Speech -> Text, Text -> Speech
- **Entity recognition** – Categorize by type and subtype; Today = date; Driveway = location
- **Language Modelling** – Common Language
- **Sentiment Analysis** – Prebuilt model 0-1 (neg-pos)
- **Translation** – 60+ Languages, Context aware
- Services

Common Machine Learning Types

- **Deep learning** – Neural networks, Large dataset
- **Experiment**
- **Classification** – Supervised, Historical data, **Binary**: Is it an Apple? Is it A, B, or C? Is it a ...?
- **Regression** – Supervised, Historical data, **Numeric**: How much? How many?
- **Clustering** – Unsupervised, unlabeled data, Find **similar** groups, How is this organized?
- Common Types

https://aka.ms/mlcheatsheet

X Sentiments

Marketing campaigns

Weather predictions

Feature
- Input variable
- Life insurance example: Smoker, Gender

Label
- Thing we predict
- Life insurance example: Life expectancy

Training
- Split date 50:50
- Training : Actual
- Compare actual to predicted
- Mean Square Error

Tools
- Notebooks
- Automated ML
- Designer

Azure Portal → All Services → AI + Machine Learning → AI Machine Learning
1. New workspace
2. Launch studio
3. Create compute "instance" to work
4. Create compute "cluster" for ML training
5. Automate ML (no-code option) or ML Designer (low-code option)

Compute
- Compute Instances
- Compute Clusters
- k8s Clusters
- Attached Compute
  - Managed outside of Azure
  - Managed yourself

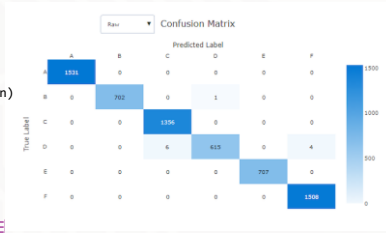
Metrics (Clustering)
- Average Distance to Other Center
- Average Distance to Cluster Center
- Combined Evaluation
- Maximal Distance to Cluster Center
- Number of Points

Metrics (Regression)
- Coefficient of determination
- Mean Absolute error (MAE)
- Root mean squared error (RMSE)
- Relative Absolute error (RAE)
- Relative Squared error (RSE)

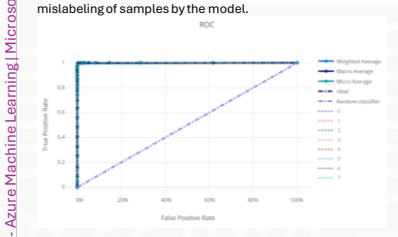
Metrics (Classification)
- Accuracy [0,1] (! for AI Vision)
- Area Under curve (AUC) [0,1]
  - AUC=1 is best fitted model.
  - AUC<0.5 is worse than random
- Confusion Matrix
- F1 Score
- Precision [0,1]
- Recall [0,1]
- Selectivity [0,1]
- Weighted accuracy [0,1]

Training
- Bring/Gather Data
- Transform Data
  - Feature Select
  - Find &Clean outliers
  - Impute missing values
  - Normalize

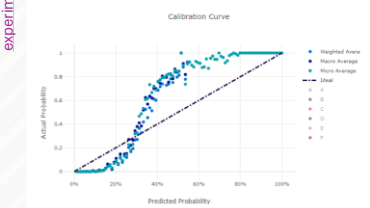
experiment results - Azure Machine Learning | Microsoft Learn



Confusion matrices visually demonstrate the systematic errors of a classification model, with "confusion" referring to the mislabeling of samples by the model.



The **receiver operating characteristic** (ROC) curve illustrates the connection between the true positive rate (TPR) and the false positive rate (FPR) as the decision threshold is varied. The area under the curve (AUC) represents the fraction of correctly classified instances.



A **calibration curve** shows a model's confidence in predictions versus the proportion of correct positive samples at each confidence level. An ideal model accurately classifies 100% of predictions with 100% confidence, 50% with 50% confidence, and 20% with 20% confidence. A perfectly calibrated model's curve matches the y = x line, where probabilities are predicted flawlessly.

Generative AI Workloads

- **Image Creation** – Art, Impressionism, Face
- **Others** – Discovery, Gaming, Security, Simulations
- **Text Generation** – ChatGPT, Copilot
- **Video Generation** – Deep Fakes, Animation
- **Code Generation**
- **Music, Audio Generation** – Voice synthesis, Sound effects
- Responsible Generative AI

- Copilot Studio (low code)
- Azure AI Studio (PaaS)

Confusion Matrix

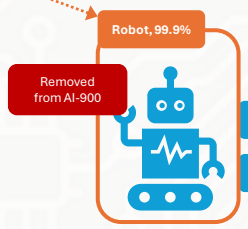
	<X>	<!X>
recall / Is A <X>	TP	FN
Is NOT <X>	FP	TN

Actuals (specificity) / Predictions (precision)

```
Accuracy    = (TP+TN)/(TP+TN+FP+FN)
Recall      = TP/(TP+FN)
Precision   = TP/(TP+FP)
Specificity = (TN/(FP+TN)
F1 Score    = (2*Recall*Precision)/
              (Recall + Precision)
```

Azure Portal → All Services → AI + Machine Learning

- **Cognitive Services** – Umbrella service; Includes many other services
- **Computer Vision Services** – Pre-trained LM model; Can **recognize** and **categorize** 10,000 objects; Detect faces and text recognition
- **Custom Vision Services** – Model you can build and train; Classification or object detection (**class name**, **probability score**, **bounding box**)
- **Face Services** – Recognize a human face on an image; Returns coordinates of 1+ faces; Recognizes pre-trained celebrities
  - **Face Detection** – Gender, Age, Face boundaries
  - **Face Verification** – Compare faces; Identify if same individual
  - **Similar Faces** – Identify similar faces
  - **Face Grouping** – Divides a set of unknown faces into groups based on similarities
  - **Identify API** – Identify (assign names) to faces
- **Form Recognizer Service** – Ideal for invoices and receipts; **Pre-built** or **custom** model; Pre-built = English in USA
- **AI Video Indexer** – Build on Az Media Services and Azure AI Services (**Face**, Translator, **Vision**, Speech); Allows extraction of insights from videos



- **Agents or Bots** – Conversational AI; Computer and humans talk; Operate over web, email, social media, and voice
- **Conversational Services** – QnA Maker Service – codeless chatbot; Azure Bot Service – Enterprise grade

- **Text Analysis Service** – Key phrase extraction; Entity detection; Sentiment analysis (positive=1,neutral=0.5, negative=0); Language detection; Returns NaN for undetermined
- **Language Understanding Service (LUIS)** – Understand natural language; **Utterances** – *when do you close?*; **Entities** – *today (date time)*; **Intents** – *goal: total hours of operation*; No intent – *what is the meaning of life?*
- **Speech Service** – Text to speech; Speech to text; Auto translation; Custom voice models
- **Translator Text Service** – Translate between 70 languages; Custom models; Language detection
  - ISO 6391 Code
  - Language Name
  - Score

- **Dangers** – Deep fakes; Impersonation; Harmful; Discriminating
- **Process** – 1. Identify harm – *what is worst case scenario?* 2. Measure harms – *try to generate harmful content* 3. Mitigate harms - *fine-tune model and filters, meta prompts, grounding data* 4. Operate responsibly - *monitor, feedback, track telemetry*

Willy's Notes