Monday, January 27, 2025 1:27 PM

**Shapley values provide a local explanation by quantifying the contribution of each feature to the prediction for a specific instance, while PDP provides a global explanation by showing the marginal effect of a feature on the model's predictions across the dataset. Use Shapley values to explain individual predictions and PDP to understand the model's behavior at a dataset level**

Confusion matrix is a tool specifically designed to evaluate the performance of classification models by displaying the number of true positives, true negatives, false positives, and false negatives. This matrix provides a detailed breakdown of the model's performance across all classes, making it the most suitable choice for evaluating a classification model's accuracy and identifying potential areas for improvement.

**Root Mean Squared Error (RMSE)** - Root Mean Squared Error (RMSE) is a metric commonly used to measure the average error in regression models by calculating the square root of the average squared differences between predicted and actual values. However, RMSE is not suitable for classification tasks, as it is designed to measure continuous outcomes, not discrete class predictions.

**Mean Absolute Error (MAE)** - Mean Absolute Error (MAE) measures the average magnitude of errors in a set of predictions without considering their direction. MAE is typically used in regression tasks to quantify the accuracy of a continuous variable's predictions, not for classification tasks where the outputs are categorical rather than continuous.

**Correlation matrix** - Correlation matrix measures the statistical correlation between different variables or features in a dataset, typically used to understand the relationships between continuous variables. A correlation matrix is not designed to evaluate the performance of a classification model, as it does not provide any insight into the accuracy or errors of categorical predictions.

**Sampling bias**
This is the correct answer because sampling bias occurs when the data used to train the model does not accurately reflect the diversity of the real-world population. If certain ethnic groups are underrepresented or overrepresented in the training data, the model may learn biased patterns, causing it to flag individuals from those groups more frequently. In this scenario, sampling bias leads to discriminatory outcomes and unfairly targets specific groups based on ethnicity.

**Measurement bias** - Measurement bias is not the correct explanation because it involves inaccuracies in data collection, such as faulty equipment or inconsistent measurement processes. This type of bias does not inherently affect the demographic composition of the dataset and, therefore, is not directly responsible for bias based on ethnicity in the model's outputs.

**Observer bias** - Observer bias is irrelevant in this context because it relates to human errors or subjectivity during data analysis or observation. Since the AI model processes the data autonomously without human intervention, observer bias is not a factor in the biased outcomes of the model.

**Confirmation bias** - Confirmation bias involves selectively searching for or interpreting information to confirm existing beliefs. This type of bias does not apply to the AI system in this scenario, as there is no indication that the model is designed to reinforce any preconceptions or assumptions related to ethnicity.

**Top K**
Top K represents the number of most likely candidates that the model considers for the next token. Choose a lower value to decrease the size of the pool and limit the options to more likely outputs. Choose a higher value to increase the size of the pool and allow the model to consider less likely outputs.

**Temperature** - Temperature is a value between 0 and 1, and it regulates the creativity of the model's responses. Use a lower temperature if you want more deterministic responses, and use a higher temperature if you want more creative or different responses for the same prompt on Amazon Bedrock.

**Top P** - Top P represents the percentage of most likely candidates that the model considers for the next token. Choose a lower value to decrease the size of the pool and limit the options to more likely outputs. Choose a higher value to increase the size of the pool and allow the model to consider less likely outputs.

**Decision Trees**
Decision Trees are highly interpretable models that provide a clear and straightforward visualization of the decision-making process. Decision Trees work by splitting the data into subsets based on the most significant features, resulting in a tree-like structure where each branch represents a decision rule.

**Logistic Regression** - Logistic Regression is primarily designed for binary classification problems. While it can be adapted for multiclass classification, it may not perform effectively with a large number of categories or a complex dataset like a massive movie database. Additionally, logistic regression does not provide an easily interpretable structure that illustrates how each feature influences the final output, making it less suitable for the company's requirements.

**Neural Networks** - This option is incorrect because, although neural networks are powerful tools for handling large and complex datasets, they are often considered "black-box" models due to their lack of transparency. Neural networks involve multiple layers of neurons and nonlinear transformations, making it difficult to understand and document the inner workings of the model. Given the company's need for transparency and an understanding of how the model affects the output, neural networks are not the best choice.

**Support Vector Machines (SVMs)** - This option is incorrect because, while SVMs are effective for classification tasks, especially in high-dimensional spaces, they do not inherently provide an interpretable way to understand the decision-making process. SVMs create a hyperplane to separate classes, but it is not straightforward to explain how individual features impact the final classification. This lack of interpretability makes SVMs less suitable for a company that wants to document and understand the inner workings of the model.

Model parameters are values that define a model and its behavior in interpreting input and generating responses. Hyperparameters are values that can be adjusted for model customization to control the training process.

Image processing focuses on enhancing and manipulating images for visual quality, whereas computer vision involves interpreting and understanding the content of images to make decisions

Feature engineering for structured data often involves tasks such as normalization and handling missing values, while for unstructured data, it involves tasks such as tokenization and vectorization

Interpretability is about understanding the internal mechanisms of a machine learning model, whereas explainability focuses on providing understandable reasons for the model's predictions and behaviors to stakeholders

ChatGPT or Chat Generative Pretrained Transformer is an example of a Transformer model. Transformer-based models use a self-attention mechanism. They weigh the importance of different parts of an input sequence when processing each element in the sequence.

**Amazon Q in Connect**
Amazon Connect is the contact center service from AWS. Amazon Q helps customer service agents provide better customer service. Amazon Q in Connect uses real-time conversation with the customer along with relevant company content to automatically recommend what to say or what actions an agent should take to better assist customers.
Incorrect options:
**Amazon Q Developer** - Amazon Q Developer assists developers and IT professionals with all their tasks—from coding, testing, and upgrading applications, to diagnosing errors, performing security scanning and fixes, and optimizing AWS resources.
**Amazon Q Business** - Amazon Q Business is a fully managed, generative-AI powered assistant that you can configure to answer questions, provide summaries, generate content, and complete tasks based on your enterprise data. It allows end users to receive immediate, permissions-aware responses from enterprise data sources with citations, for use cases such as IT, HR, and benefits help desks.
**Amazon Q in QuickSight** - With Amazon Q in QuickSight, customers get a generative BI assistant that allows business analysts to use natural language to build BI dashboards in minutes and easily create visualizations and complex calculations.

Data access control involves authentication and authorization of users, whereas data integrity ensures the data is accurate, consistent, and unaltered

Model training in deep learning involves using large datasets to adjust the weights and biases of a neural network through multiple iterations, using techniques such as gradient descent to minimize the error

Neural networks consist of layers of nodes (neurons) that process input data, adjusting the weights of connections between nodes through training to recognize patterns and make predictions

SageMaker model cards include information about the model such as intended use and risk rating of a model, training details and metrics, evaluation results, and observations. AI service cards provide transparency about AWS AI services' intended use, limitations, and potential impacts

Feature extraction reduces the number of features by transforming data into a new space, while feature selection reduces the number of features by selecting the most relevant ones from the existing features

K-Means is an unsupervised learning algorithm used for clustering data points into groups, while KNN is a supervised learning algorithm used for classifying data points based on their proximity to labeled examples

While CNNs are used for single image analysis, RNNs are used for video analysis

Convolutional Neural Networks (CNNs) are specifically designed for processing and classifying image data.

**Recurrent Neural Networks (RNNs)** - Recurrent Neural Networks (RNNs) are typically used for sequence data, such as time series or natural language processing tasks. RNNs are not the best fit for image classification.
**Generative Adversarial Networks (GANs)** - Generative Adversarial Networks (GANs) are used for generating new data that resembles the training data, such as creating realistic images, but are not specifically designed for image classification

Precision, Recall, and F1-Score are standard performance metrics used to evaluate the effectiveness of a classification system:

**Mean Absolute Error (MAE), Root Mean Squared Error (RMSE) and R-squared** - Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and

R-squared are metrics used to evaluate regression models, not classification systems.
**Throughput, Latency and Uptime** - Throughput, Latency, and Uptime are performance metrics used to measure system performance and reliability, not specific to classification systems.
**Bias and Variance** - Bias refers to the error introduced by approximating a real-world problem, which may be complex, with a simplified model.

In traditional machine learning, a data scientist manually determines the set of relevant features that the software must analyze, whereas in deep learning, the data scientist gives only raw data to the software and the deep learning network derives the features by itself

Deep learning is a subset of machine learning that uses neural networks with many layers to learn from large amounts of data, while traditional machine learning algorithms often require feature extraction and can use various methods such as decision trees or support vector machines

Diffusion models create new data by iteratively making controlled random changes to an initial data sample

Risk management in the Generative AI Security Scoping Matrix involves identifying potential threats to generative AI solutions and recommending mitigations. It encompasses activities like risk assessments and threat modeling, which are essential for understanding and addressing the unique risks associated with generative AI workloads.

Top-p limits the number of tokens based on their cumulative probabilities, while top-k specifies a fixed number of most probable tokens to consider.

The provisioned throughput model is designed for steady workloads, offering consistent performance with pre-purchased units of token processing capacity.

AI agents do not manually code rules. They operate based on predefined rules or learning algorithms. The whole purpose of AI agents is to automate tasks and make decisions without manual intervention, so coding new rules manually is not a task they perform.

The correct role of the discriminator in a Generative Adversarial Network (GAN) is to evaluate and classify data as real or fake. By providing feedback to the generator based on its classification, the discriminator helps improve the quality of the generated data over time.

Early stopping prevents overfitting, while a validation set ensures that the model generalizes to new data

**Automated Data Discovery** This feature allows organizations to automatically identify and classify sensitive data, such as personally identifiable information (PII) and financial data, within their Amazon S3 buckets. It helps in protecting sensitive data by continuously monitoring and alerting on potential security risks or policy violations.

**S3 Object Lock** S3 Object Lock is a feature of Amazon S3 that allows organizations to enforce write-once-read-many (WORM) policies on their objects, preventing them from being deleted or overwritten for a fixed amount of time. While it helps in protecting data from accidental or malicious deletion, it does not discover or classify sensitive data.

**Access Analyzer**
It is part of **AWS Identity and Access Management (IAM) Access Analyzer**, which is designed to help you analyze and monitor access to your AWS resources. **AWS IAM Access Analyzer** enables you to identify resources in your organization or account, such as S3 buckets, KMS keys, Lambda functions, and more, that are shared with external entities (like other AWS accounts or publicly). It generates findings based on resource policies to help you understand unintended access or overexposed resources.

**Content moderation** Content moderation in Amazon Rekognition is the correct service to utilize for ensuring that user-uploaded images do not contain any inappropriate content. This service uses machine learning models to detect explicit or suggestive content, violence, and other inappropriate material in images, making it ideal for the social media platform's needs

**Transparency** Transparency ensures that the AI model's decisions and processes are understandable and explainable, which is key to detecting and correcting potential biases.

Safety Safety ensures the model avoids harmful outcomes.
**Veracity** Veracity focuses on reliability and accuracy.
**Scalability** Scalability refers to the ability of the AI system to handle increasing amounts of work or to be expanded across different environments. While important, it is not directly related to the fairness or explainability of the model.

**Fairness** Fairness is a core dimension of responsible AI that ensures the model treats all individuals and groups equally and does not discriminate against any particular group. It involves promoting inclusiveness and addressing biases in the training data and model algorithms.

Amazon Comprehend Medical has the ability to automatically detect and remove Protected Health Information (PHI) from medical documents. This is crucial for compliance with privacy laws like HIPAA, which mandate the removal of identifiable patient information in certain contexts. De-identification ensures that healthcare organizations can analyze data while safeguarding patient privacy.

**AWS Security Hub** AWS Security Hub is the correct choice as it helps you gain insight into the security posture of your AWS environment by providing a unified view of security data from various AWS services. It aggregates, organizes, and prioritizes security findings from multiple AWS services such as Amazon GuardDuty, Amazon Inspector, and AWS Macie.

**Generator in GAN** The generator is responsible for creating fake data that mimics the real data. It learns to produce data that becomes increasingly realistic over time as it receives feedback from the discriminator.

**High temperature, high Top P** High temperature introduces randomness for creativity, and high Top P allows for a broader range of words while still limiting unlikely tokens. This combination ensures diverse yet plausible outputs.

**The harmonic mean of precision and recall, balancing both precision and recall** The **F1 score** is the **harmonic mean of precision and recall**, balancing the trade-off between the two metrics. It gives equal weight to both precision and recall, making it useful for evaluating models where false positives and false negatives are equally important.

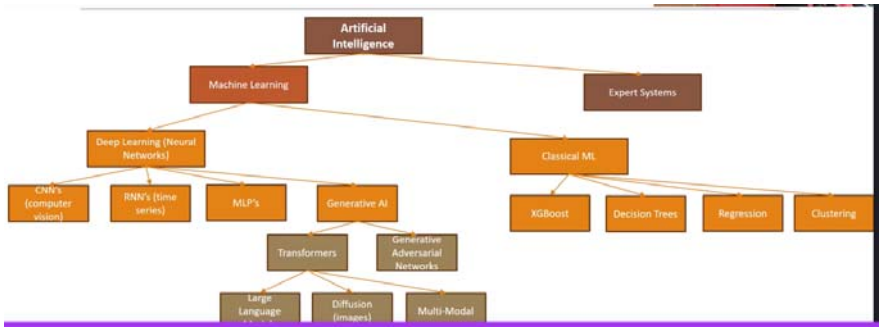
SageMaker Autopilot automatically builds, trains, and tunes machine learning models, allowing users to get predictions without needing deep knowledge of machine learning.

Slot types are used to define parameters that must be collected from the user (e.g., account number, inquiry reason) to complete the intent.
**Intents** Intents represent the user's goal or action, such as "report an issue," but they do not collect specific details required to fulfill the intent.
**Fallback intents**Fallback intents are used when the bot cannot recognize the user's input, not for gathering specific information.\

**Generative Adversarial Networks (GANs)**
Generative Adversarial Networks (GANs) are a type of deep learning model that consists of two neural networks, a generator, and a discriminator, that work together to generate new data samples. GANs are a common example of generative AI technology as they are used to create realistic synthetic data.
**K-Nearest Neighbors (KNN)**
K-Nearest Neighbors (KNN) is a simple algorithm used for classification and regression tasks in machine learning. It is not considered generative AI technology as it does not generate new data points but rather makes predictions based on existing data points.

**Decision Trees**
Decision Trees are a type of supervised machine learning algorithm used for classification and regression tasks. They are not considered generative AI technology as they do not generate new data points but rather make decisions based on existing data.

On-demand serverless inference is ideal for workloads with idle periods and traffic spikes. Its advantage is automatic scaling, which reduces management overhead by handling the underlying infrastructure automatically. However, it can potentially incur higher costs during peak usage times due to the dynamic scaling.

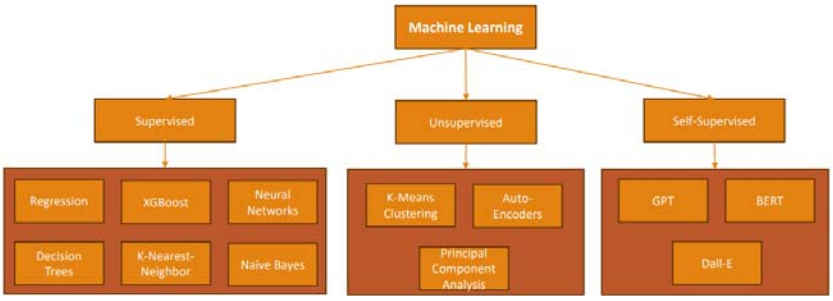


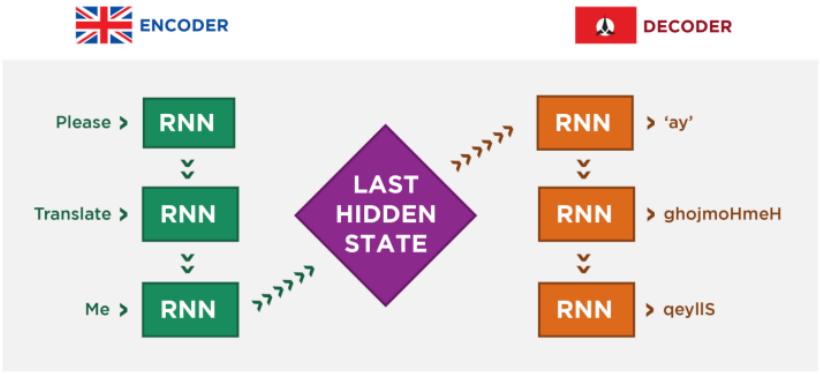

K-fold Cross Validation for Overfitting--- Split your data into K randomly-assigned segments ◦ Reserve one segment as your test data ◦ Train on each of the remaining K-1 segments and measure their performance against the test set ◦ Take the average of the K-1 r-squared scores

Unsupervised lerning: K-Means Clustering ◦ We start by picking K centroids at random ◦ Assign each point to the closest centroid ◦ Recompute each centroid based on chosen points ◦ Iterate until assignments don't change

What is regularization? Preventing overfitting

Bias is how far removed the mean of your predicted values is from the "real" answer
Variance is how scattered your predicted values are from the "real" answer




Self attention- 1 word 2 meaning

**Residual Neural Networks** (AKA ResNet) are normally used in **image recognition.**
**WaveNet** is used for generating audio, specifically for **text-to-speech** applications.

### N-grams (Sequences of N words used in BLEU and ROUGE metrics)

N-grams are sequences of N words used in metrics like BLEU and ROUGE to evaluate the similarity between text samples based on exact word matches. They do not focus on the meaning of words in context, but rather on the presence of specific word sequences.

**ROUGE (Recall-Oriented Understudy for Gisting Evaluation)**ROUGE (Recall-Oriented Understudy for Gisting Evaluation) is a metric used in natural language processing tasks to evaluate the quality of text summaries based on exact word matches. It measures the overlap of words between the generated summary and the reference summary, without considering the context or meaning of the words.

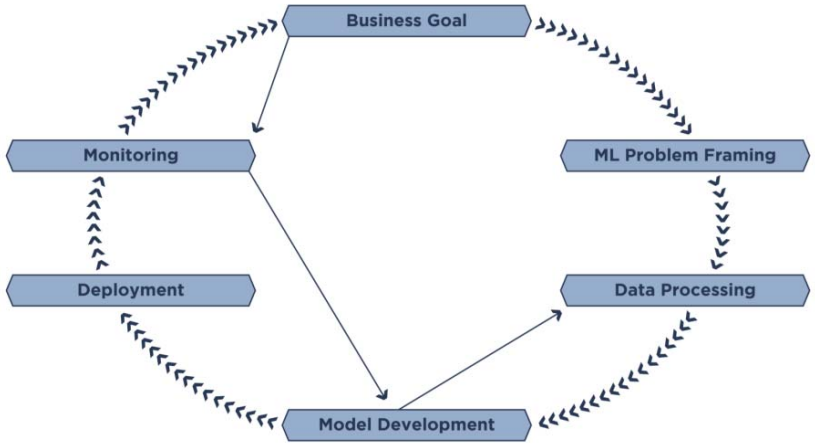
### BLEU (Bilingual Evaluation Understudy)

BLEU (Bilingual Evaluation Understudy) is a metric commonly used in machine translation tasks to evaluate the quality of translated text based on exact word matches. It focuses on precision and recall of matching words without considering the context or meaning of the words.

**BERTScore (Bidirectional Encoder Representations from Transformers Score)**
BERTScore (Bidirectional Encoder Representations from Transformers Score) is a metric that focuses on evaluating the quality of text based on the meaning of words in context rather than exact word matches. It uses pre-trained contextual embeddings from BERT models to capture the semantic similarity between words and sentences, making it a more advanced and context-aware metric compared to BLEU and ROUGE.

Topic-specific controls enable administrators to block entire topics, such as employee salaries, ensuring that the AI assistant does not provide information on sensitive subjects.

Dimension reduction techniques, such as Principal Component Analysis (PCA), reduce the number of input variables by transforming them into a smaller subset of features. This helps in simplifying the model, preventing overfitting, and improving performance by focusing on the most important information.




Model explainiblity- Sagemaker clarify

Establish ML roles and responsibilities
- SageMaker Role Manager

Prepare an ML profile template
- Document the resources required

Establish model improvement strategies
- SageMaker Experiments, hyper-parameter optimization, AutoML

Establish a lineage tracker system
- SageMaker Lineage Tracking, Pipelines, Studio, Feature Store, Model Registry

Establish feedback loops across ML lifecycle phases
- SageMaker Model Monitor, CloudWatch, Amazon Augmented AI (A2I)

Review fairness and explainability (SageMaker Clarify)

Design data encryption and obfuscation (Glue DataBrew)

Use APIs to abstract change from model consuming applications
- SageMaker + API Gateway

Adopt a machine learning microservice strategy
- Lambda, FarGate

Use purpose-built AI and ML services and resources
- SageMaker, JumpStart, marketplace

Define relevant evaluation metrics

Identify if machine learning is the right solution

Tradeoff analysis on custom versus pre-trained models

Profile data to improve quality
- Amazon's data engineering & analysis tools
- Data Wrangler, Glue, Athena, Redshift, Quicksight...

Create tracking and version control mechanisms
- SageMaker model registry, store notebooks in git, SageMaker Experiments

Ensure least privilege access

Secure data and modeling environment
- Use analysis environments in the cloud (SageMaker, EMR, Athena...)
- IAM, KMS, Secrets Manager, VPC's / PrivateLink

Protect sensitive data privacy (Macie)

Enforce data lineage (SageMaker ML Lineage Tracker)

Keep only relevant data
- Remove PII with Comprehend, Transcribe, Athena...

Automate operations through MLOps and CI/CD
- CloudFormation, CDK, SageMaker Pipelines, Step Functions

Establish reliable packaging patterns to access approved public libraries
- ECR, CodeArtifact

Secure governed ML environment

Secure inter-node cluster communications
- SageMaker inter-node encryption, EMR encryption in transit

Protect against data poisoning threats
- SageMaker Clarify, rollback with SageMaker Model Registry & Feature Store

Enable CI/CD/CT automation with traceability
- MLOps Framework, SageMaker Pipelines

Ensure feature consistency across training and inference
- SageMaker Feature Store

Ensure model validation with relevant data
- SageMaker Experiments, SageMaker Model Monitor

Establish data bias detection and mitigation
- SageMaker Clarify

Optimize training and inference instance types

Explore alternatives for performance improvement
- SageMaker Experiments

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Establish a model performance evaluation pipeline
- SageMaker Pipelines, Model Registry

Establish feature statistics
- Data Wrangler, Model Monitor, Clarify, Experiments

Perform a performance trade-off analysis
- Accuracy vs. complexity
- Bias vs. fairness
- Bias vs. variance
- Precision vs. recall
- Test with Experiments and Clarify

Use managed training capabilities
- SageMaker, Training Compiler, managed Spot Instances

Use distributed training
- SageMaker Distributed Training Libraries

Stop resources when not in use
- Billing alarms, SageMaker Lifecycle Configuration, SageMaker Studio auto-shutdown

Start training with small datasets

Use warm-start and checkpointing hyperparameter tuning

Use hyperparameter optimization technologies
- SageMaker automatic model tuning

Setup budget and use resource tagging to track costs
- AWS Budgets, Cost Explorer

Enable data and compute proximity

Select optimal algorithms

Enable debugging and logging
- SageMaker Debugger, CloudWatch

Establish deployment environment metrics
- CloudWatch, EventBridge, SNS

Protect against adversarial and malicious activities
- SageMaker Model Monitor

Automate endpoint changes through a pipeline
- SageMaker Pipelines

Use an appropriate deployment and testing strategy
- SageMaker Blue/Green deployments, A/B Testing, linear deployments, canary deployments

Evaluate cloud vs. edge options
- SageMaker Neo, IoT Greengrass

Choose an optimal deployment option in the cloud
- Real-time, serverless, asynchronous, batch

Use appropriate deployment option
- Multi-model, multi-container, SageMaker Edge

Explore cost effective hardware options
- Elastic Inference, Inf1 instances, SageMaker Neo

Right-size the model hosting instance fleet
- SageMaker Inference Recommender, AutoScaling

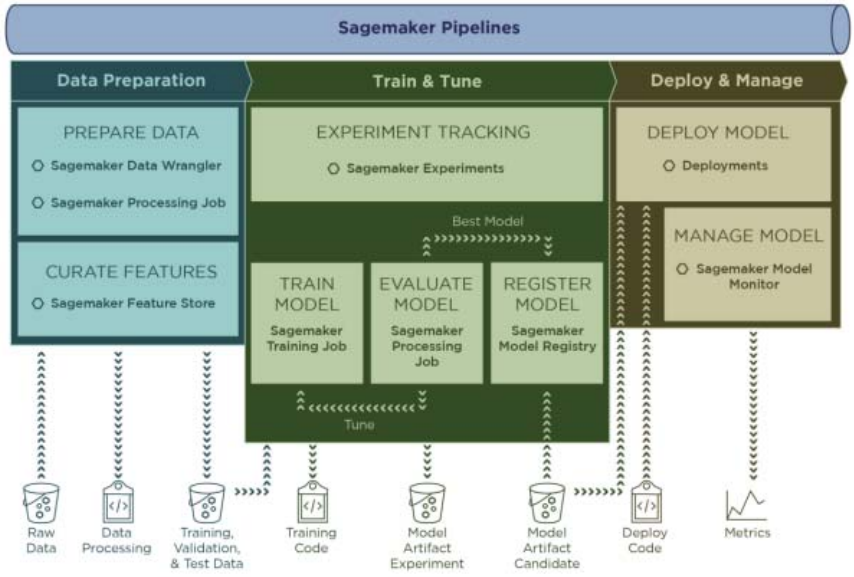
Deploy multiple models behind a single endpoint
- SageMaker Inference Pipeline

Enable model observability and tracking
- SageMaker Model Monitor, CloudWatch, Clarify, Model Cards, lineage tracking

Synchronize architecture and configuration, and check for skew across environments
- CloudFormation, Model Monitor

Restrict access to intended legitimate consumers
- Secure inference endpoints

Monitor human interactions with data for anomalous activity
- Logging, GuardDuty, Macie




**SageMaker Blue/Green Deployments allow for testing new features gradually and safely by routing a portion of traffic to the new version while keeping the old version running, ensuring controlled deployment and rollback capabilities.**

# SageMaker Model Monitor

Get alerts on quality deviations on your deployed models (via CloudWatch)

Visualize data drift

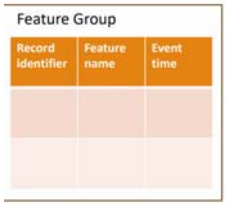
- Example: loan model starts giving people more credit due to drifting or missing input features

Detect anomalies & outliers

Detect new features

No code needed

Guardrail- content filtering in gen ai & rollback deployment in sagemaker model deployment
Shadow stte- 2 servers running parallely, comparing performance




# SageMaker ML Lineage Tracking

Creates & stores your ML workflow (MLOps)

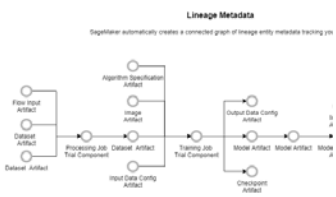
Keep a running history of your models

Tracking for auditing and compliance

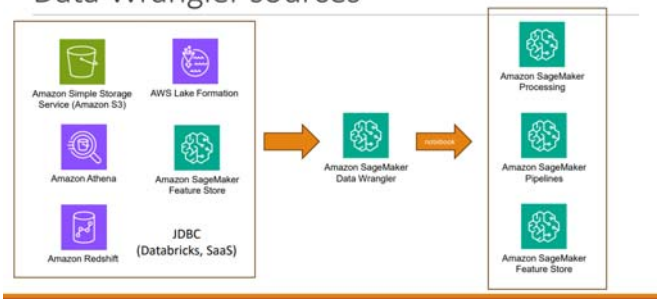
Automatically or manually-created tracking entities

Integrates with AWS Resource Access Manager for cross-account lineage

Sample SageMaker-created lineage graph:




# Data Wrangler sources



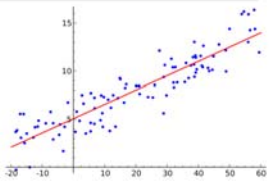

# Linear Learner: What's it for?

Linear regression

- Fit a line to your training data
- Predications based on that line

Can handle both regression (numeric) predictions and classification predictions

- For classification, a linear threshold function is used.
- Can do binary or multi-class



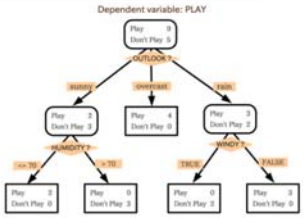
# XGBoost: What's it for?

eXtreme Gradient Boosting
- Boosted group of decision trees
- New trees made to correct the errors of previous trees
- Uses gradient descent to minimize loss as new trees are added

It's been winning a lot of Kaggle competitions
- And it's fast, too

Can be used for classification

And also for regression
- Using regression trees




# Seq2Seq: What's it for?

Input is a sequence of tokens, output is a sequence of tokens

Machine Translation

Text summarization

Speech to text

Implemented with RNN's and CNN's with attention

# DeepAR: What's it for?

Forecasting one-dimensional time series data

Uses RNN's

Allows you to train the same model over several related time series

Finds frequencies and seasonality

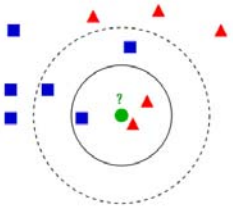
# KNN: What's it for?

K-Nearest-Neighbors

Simple classification or regression algorithm

Classification
- Find the K closest points to a sample point and return the most frequent label

Regression
- Find the K closest points to a sample point and return the average value

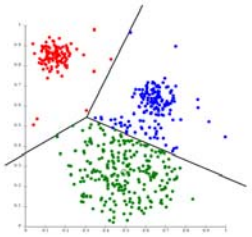


## K-Means: What's it for?

Unsupervised clustering

Divide data into K groups, where members of a group are as similar as possible to each other
- You define what "similar" means
- Measured by Euclidean distance

Web-scale K-Means clustering



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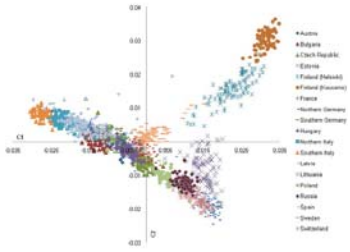
## PCA: What's it for?

Principal Component Analysis

Dimensionality reduction
- Project higher-dimensional data (lots of features) into lower-dimensional (like a 2D plot) while minimizing loss of information
- The reduced dimensions are called components
  - First component has largest possible variability
  - Second component has the next largest…

Unsupervised



Nelis M, Esko T, Ma¨gi R, Zimprich F, Zimprich A, et al. (2009) [CC BY 2.5 (https://creativecommons.org/licenses/by/2.5)]

What is the main function of SageMaker Neo? - to optimize the models for deployment on edge devices

Data lineage and provenance refer to the process of tracking the origin, transformations, and flow of data throughout its lifecycle. It helps organizations understand where data comes from, how it has been used, and how it has been transformed over time.

**Synonym support**
Synonym support in Amazon Kendra enables users to define synonyms for search terms to improve the accuracy of search results. While it enhances the search experience, it does not directly track user interactions with the search results.

**User activity tracking**
User activity tracking is a general term used to monitor and record user interactions within a system. While it is crucial for understanding user behavior, it is not a specific feature within Amazon Kendra for tracking how users interact with search results.

**Relevance tuning**
Relevance tuning in Amazon Kendra allows users to adjust the search results based on their preferences and feedback. While it is important for optimizing search results, it is not specifically designed to track user interactions with the search results.

**Search analytics**
Search analytics in Amazon Kendra provides insights into how users interact with search results, including metrics such as popular search queries, click-through rates, and user engagement. This feature is specifically designed to track and analyze user interactions, making it the correct choice for monitoring user behavior in the search results.

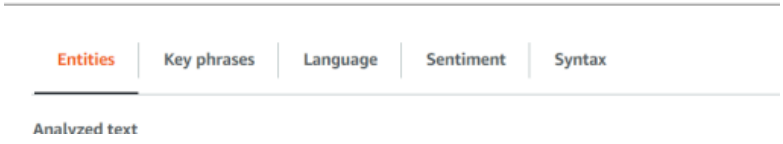
VAEs generate data by sampling from a learned distribution, typically a Gaussian distribution in the latent space. This sampling process allows VAEs to generate new data points that are similar to the training data. In contrast, GANs use adversarial training between a generator network that creates fake data samples and a discriminator network that tries to distinguish between real and fake samples.

Amazon GuardDuty continuously monitors for malicious activity and unauthorized behavior, enhancing the security of an AWS environment.\\\

A high NPS indicates high user satisfaction, as it measures the likelihood of users recommending the AI application to others.

AI systems, especially large language models and generative AI, are inherently complex and often operate as "black boxes," making it difficult to audit and understand their decision-making processes. This complexity necessitates ongoing monitoring and adaptability to ensure compliance, which is less of an issue in traditional software systems

Comprehend



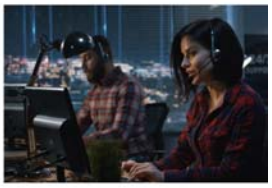

Personalize = recommendation or ranking personalize

## Amazon CodeGuru

Automated code reviews!
Finds lines of code that hurt performance
Resource leaks, race conditions
Fix security vulnerabilities
Offers specific recommendations
Powered by ML
Supports Java and Python

## Contact Lens for Amazon Connect

For customer support call centers
Ingests audio data from recorded calls
Allows search on calls / chats
Sentiment analysis
Find "utterances" that correlate with successful calls
Categorize calls automatically
Measure talk speed and interruptions
Theme detection: discovers emerging issues



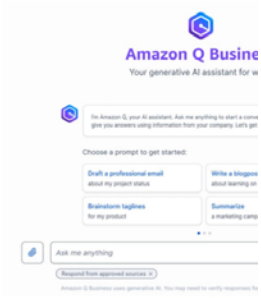
## Amazon Q Business Pricing

"Lite": $3/user/month
- Just chat

"Pro": $20/user/month
- Amazon Q Apps
- Amazon Q in QuickSight
- Custom plugins

Index pricing
- Charged by the "unit"
  - 100 hours usage included per month
  - 20,000 documents or 200MB
- $0.264 / hour / unit

This can add up fast
- 1M documents = 50 units = $9,504 / month
- 4500 "Lite" users = $13,500 / month




In Bedrock agent, code interpretor , writes its own code.

Evaluation of model= benchmark, human, another model

Similarity metrics
Rouge - Recall
BLUE= precision

BERTscore- google, embedding, semantic

Precsion ML metrices, precision, accuracy, recall, f1

--Positives

--Negatives
\ True
/ false

Below r for classification
Recall- sensitivity, fraud detection… |
Precision - relevant, drug detection ---

Specificity = $\frac{TN}{TN+FP}$ = "True negative rate"

F1 Score

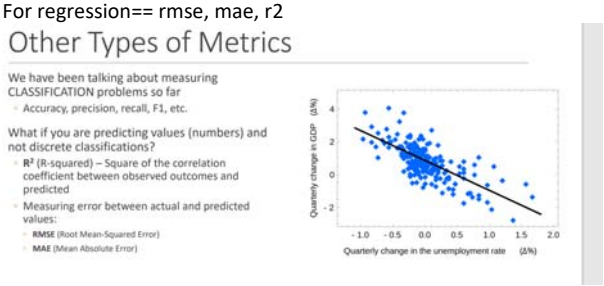
- $\frac{2TP}{2TP+FP+FN}$
- $2 \cdot \frac{Precision \cdot Recall}{Precision+Recall}$
- Harmonic mean of precision and sensitivity
- When you care about precision AND recall

RMSE

- Root mean squared error, exactly what it sounds like
- Accuracy measurement
- Only cares about right & wrong answers

ROC cureve, more upper, more good

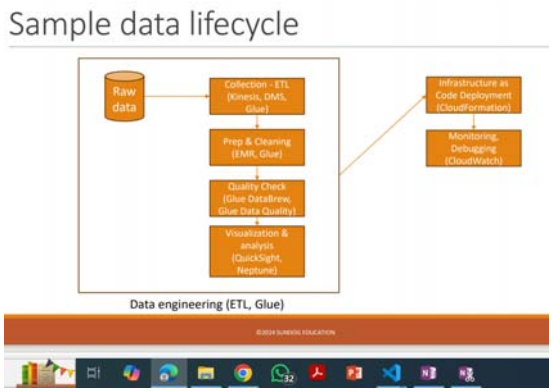
For regression== rmse, mae, r2





Shapley- one feature contributing how much

Transparency - how
Explainibility - y
Intrepretability = cause




AWS Config
- Provides a view of your AWS resource configuration
- How your resources are related
- How their configurations and relationships change over time
- Can help with requirements for frequent audits
- Can help understand dependencies your config changes might affect

Amazon Inspector
- Continuous scans for software and network vulnerabilities
- Software packages with known common vulnerabilities and exposures (CVEs)
- Exploitable code, vulnerabilities to data leaks, poor encryption
- Open network paths
- Provides a risk score based on National Vulnerability Database (NVD)

AWS Audit Manager
- Automates evidence collection
  - Including from hybrid or multi-cloud
  - Ensures evidence integrity

AWS Artifact
- On-demand AWS security and compliance documents
  - ISO certifications, PCI reports, SOC reports

AWS CloudTrail
- Logs all actions taken by users / roles / services you specify
  - Whether in console, CLI, or SDK's / API's
- Useful for operational and risk auditing, governance, compliance
  - As well as figuring out who broke something... and what was done about it.

AWS Trusted Advisor
- Continuous checks for best practices in:
  - Cost optimization, performance, resilience, security, operational excellence, service limits
- Recommends actions to correct for deviations
- Optimizes costs, increases performance, improves security and resilience

SHAP (SHapley Additive exPlanations) is the technique used by SageMaker Clarify to measure the impact of each feature by evaluating the model's performance with the feature left out.

### Precision
Precision focuses on the proportion of true positive predictions among all positive predictions.

### F1 Score
The F1 Score is the harmonic mean of precision and recall, providing a balance between the two metrics. While F1 Score considers both false positives and false negatives, it may not be the best choice when the cost of false negatives is significantly higher.

### Accuracy
Accuracy is not the best metric for evaluating the performance of the model in this scenario because it treats false negatives and false positives equally. Since the cost of a false negative is higher, accuracy may not reflect the true impact of misclassifying churn customers.

### Recall
Recall, also known as sensitivity, measures the proportion of actual positive cases that were correctly identified by the model. In this case, where false negatives are more costly, recall is crucial as it prioritizes minimizing false negatives, making it the most suitable metric for evaluating the model's performance.

**Bedrock Invocation Logging**
Bedrock Invocation Logging is the feature that allows the firm to track and analyze how frequently certain types of content are generated and used.

Continue pre training also called domain adopting\

Fine tuning is kind of transfer learning

Admin control- guardrails for amazon q business

- Metrics
  - **Precision** – Best when false positives are costly
  - **Recall** – Best when false negatives are costly
  - **F1 Score** – Best when you want a balance between precision and recall, especially in imbalanced datasets
  - **Accuracy** – Best for balanced datasets

Ground ruth for reviewing
Ground truth plus for lbelling data