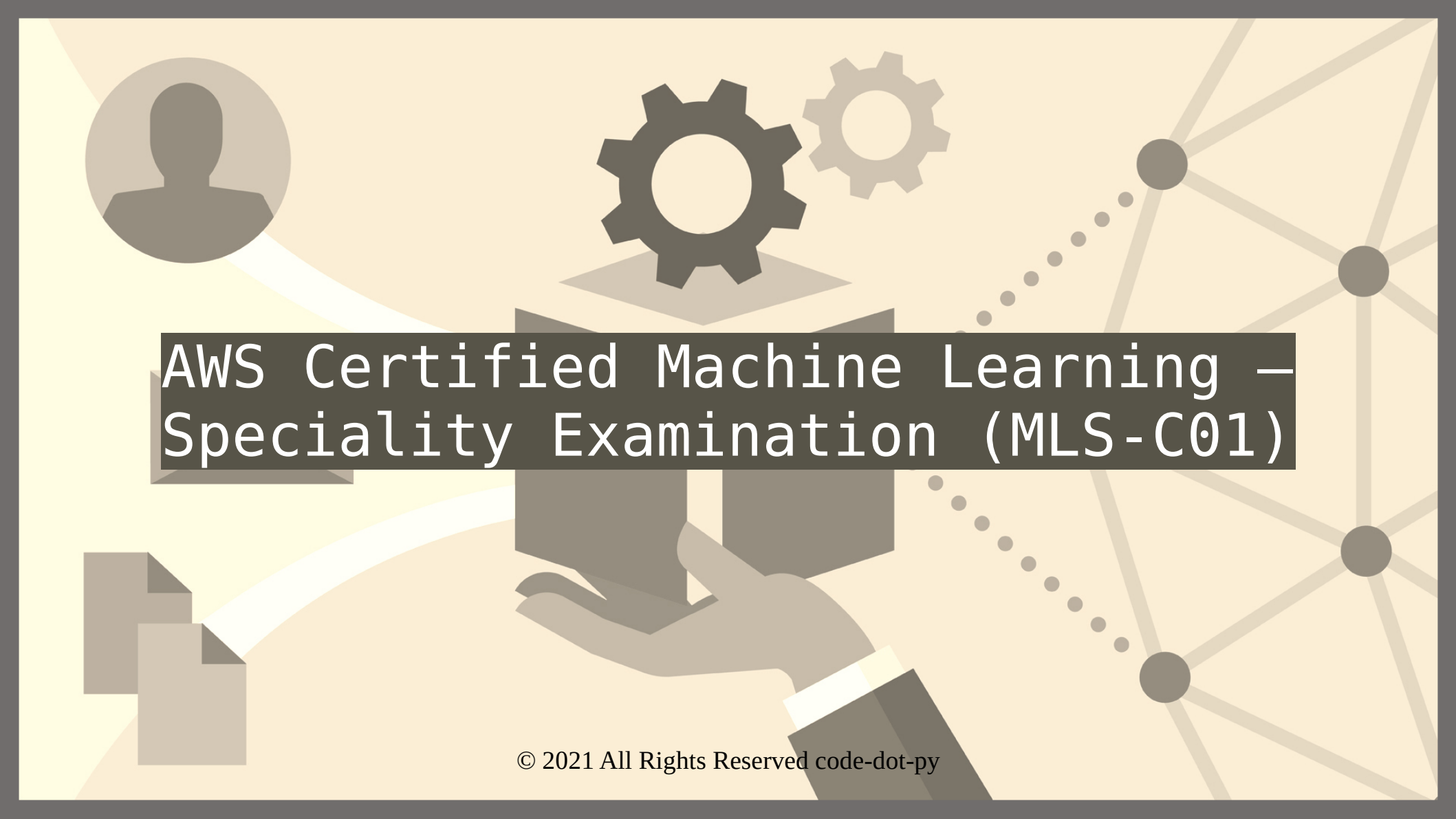
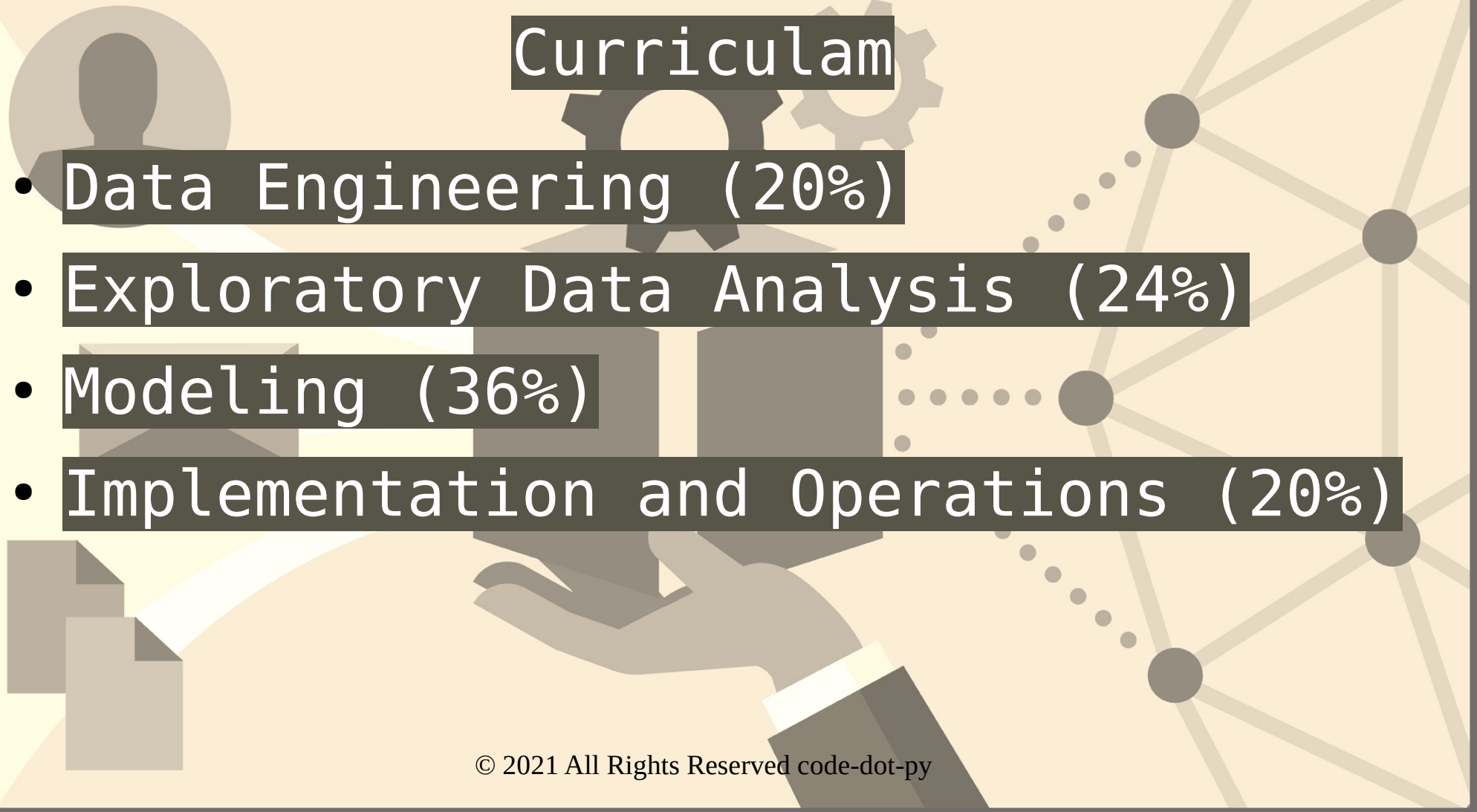


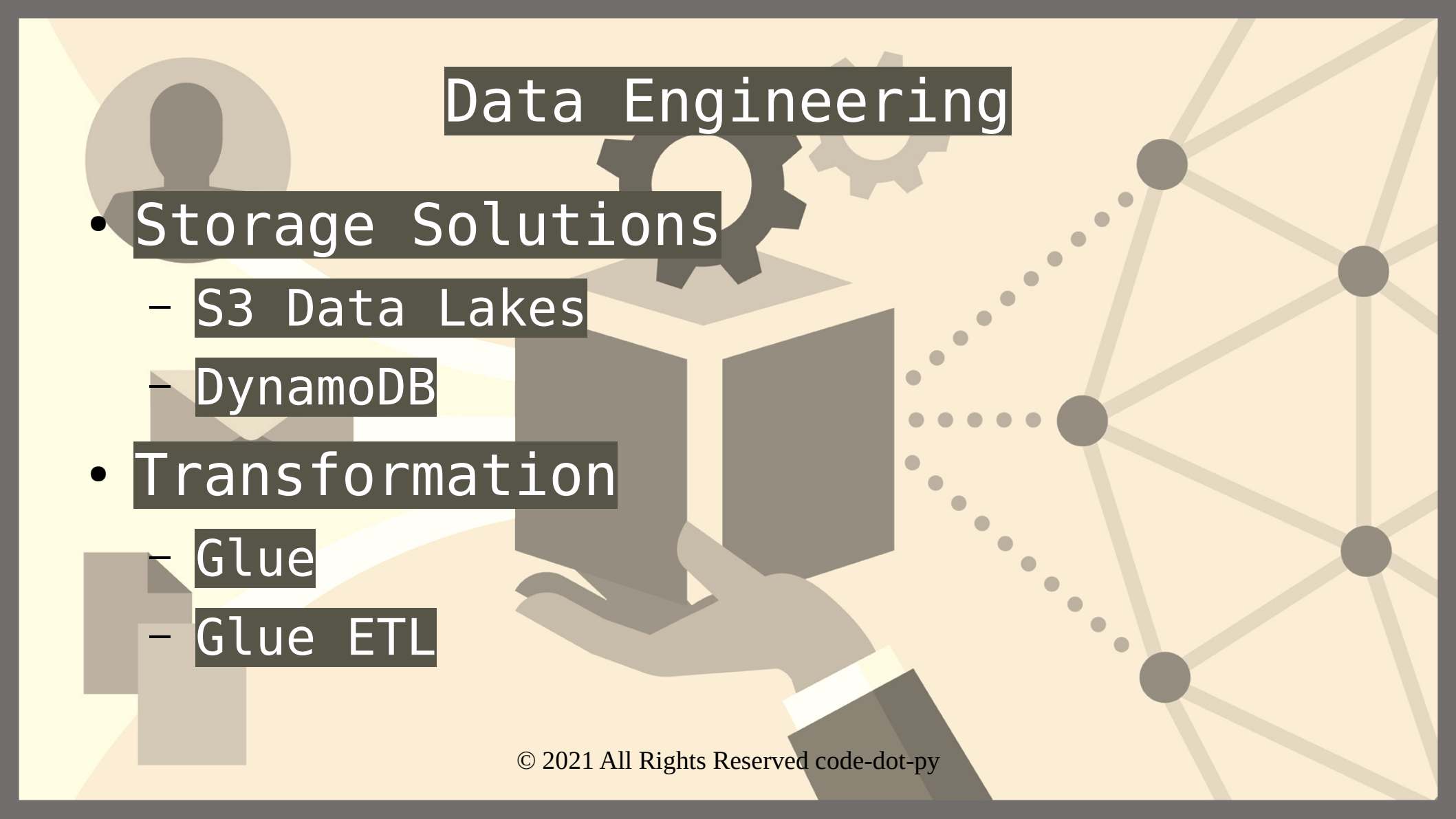
AWS Certified Machine Learning – Speciality Examination (MLS-C01)

Curriculam

- Data Engineering (20%)
- Exploratory Data Analysis (24%)
- Modeling (36%)
- Implementation and Operations (20%)

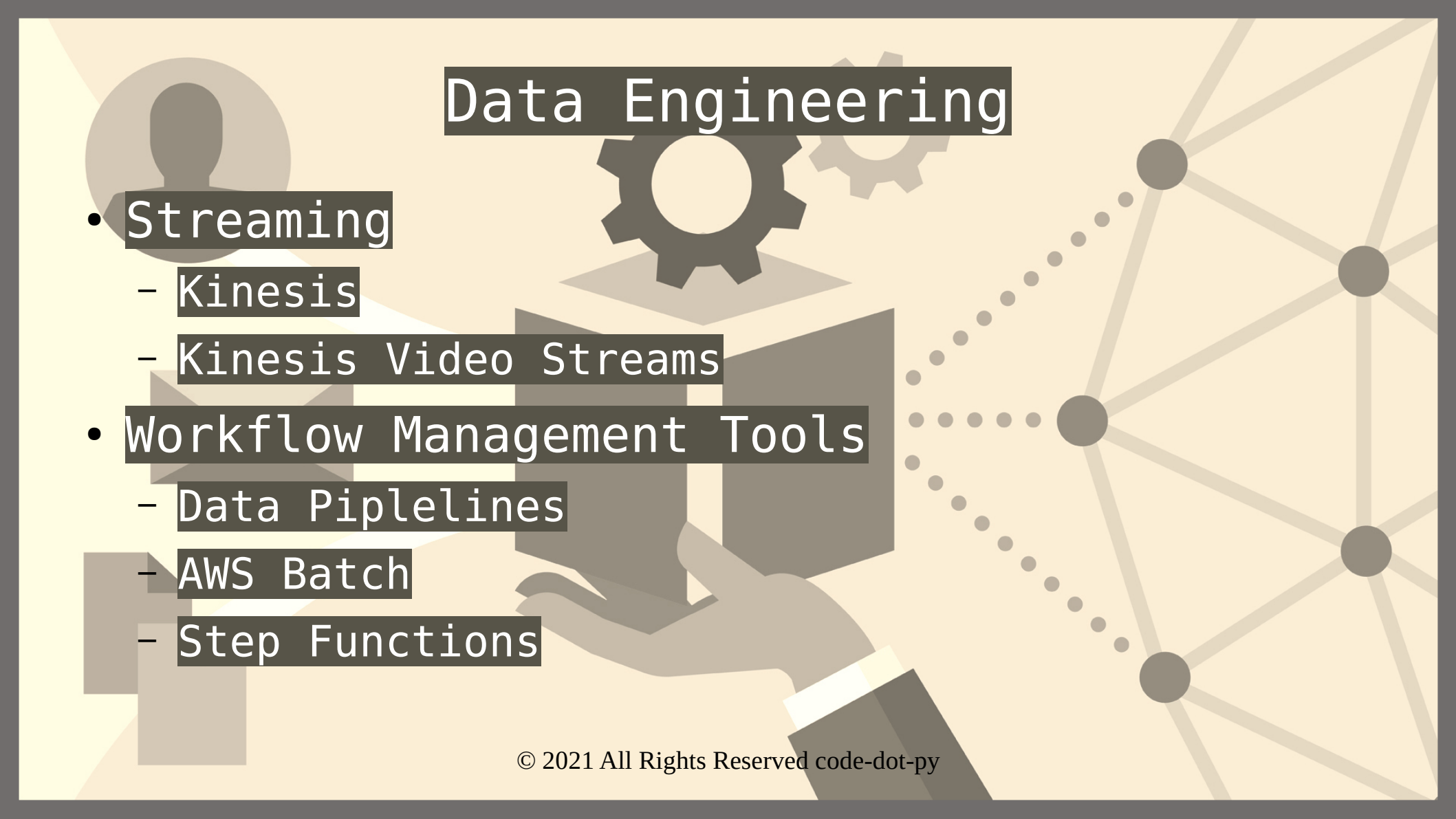


Data Engineering



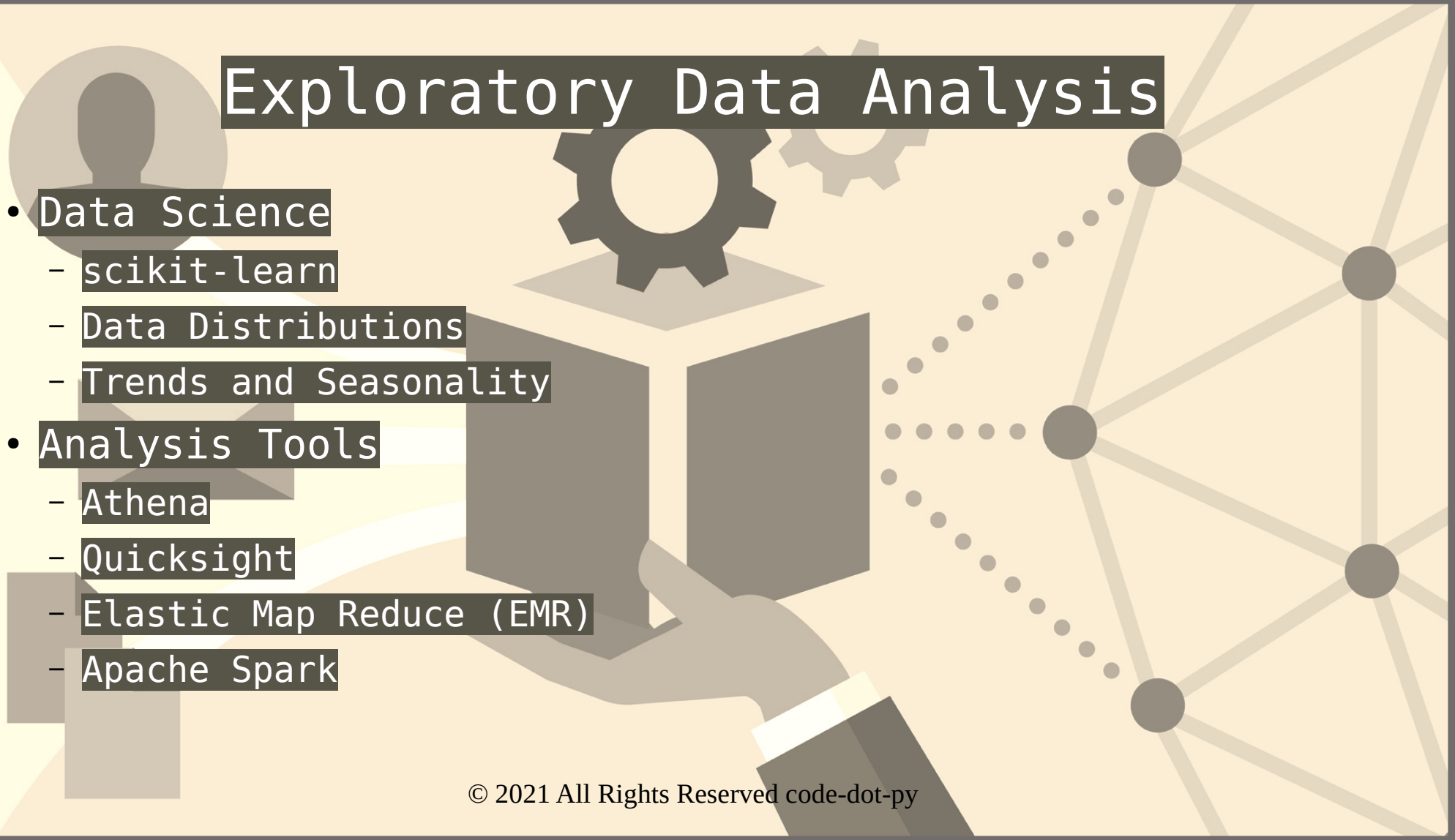
- Storage Solutions
  - S3 Data Lakes
  - DynamoDB
- Transformation
  - Glue
  - Glue ETL

Data Engineering



- Streaming
  - Kinesis
  - Kinesis Video Streams
- Workflow Management Tools
  - Data Piplelines
  - AWS Batch
  - Step Functions

Exploratory Data Analysis



- Data Science
  - scikit-learn
  - Data Distributions
  - Trends and Seasonality
- Analysis Tools
  - Athena
  - Quicksight
  - Elastic Map Reduce (EMR)
  - Apache Spark

Exploratory Data Analysis

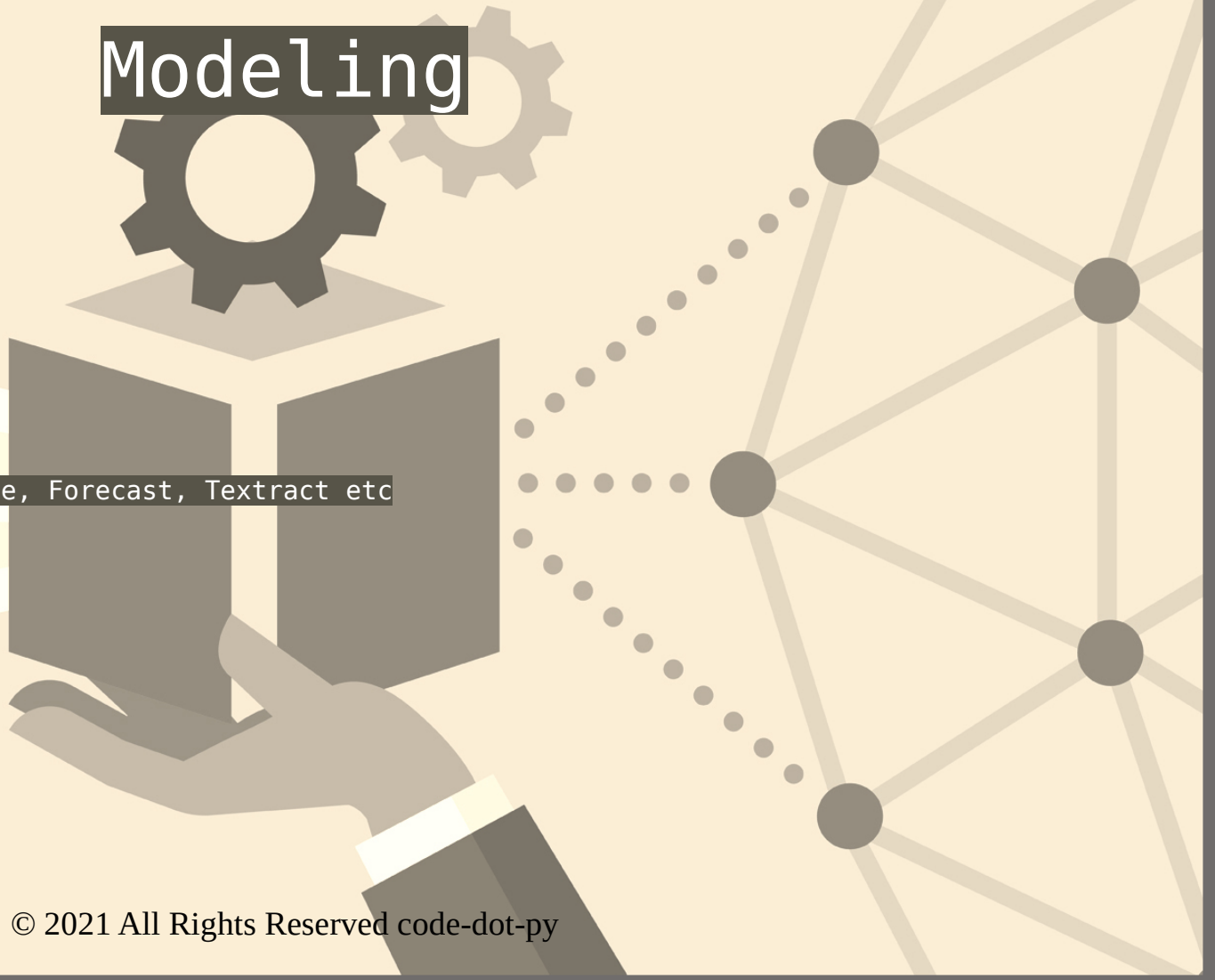
- Feature Engineering
  - Imputation methods
  - Outliers
  - Binning/Categorizing Data
  - Log transforms
  - One-hot encoding
  - Scaling and Normalization

Modeling

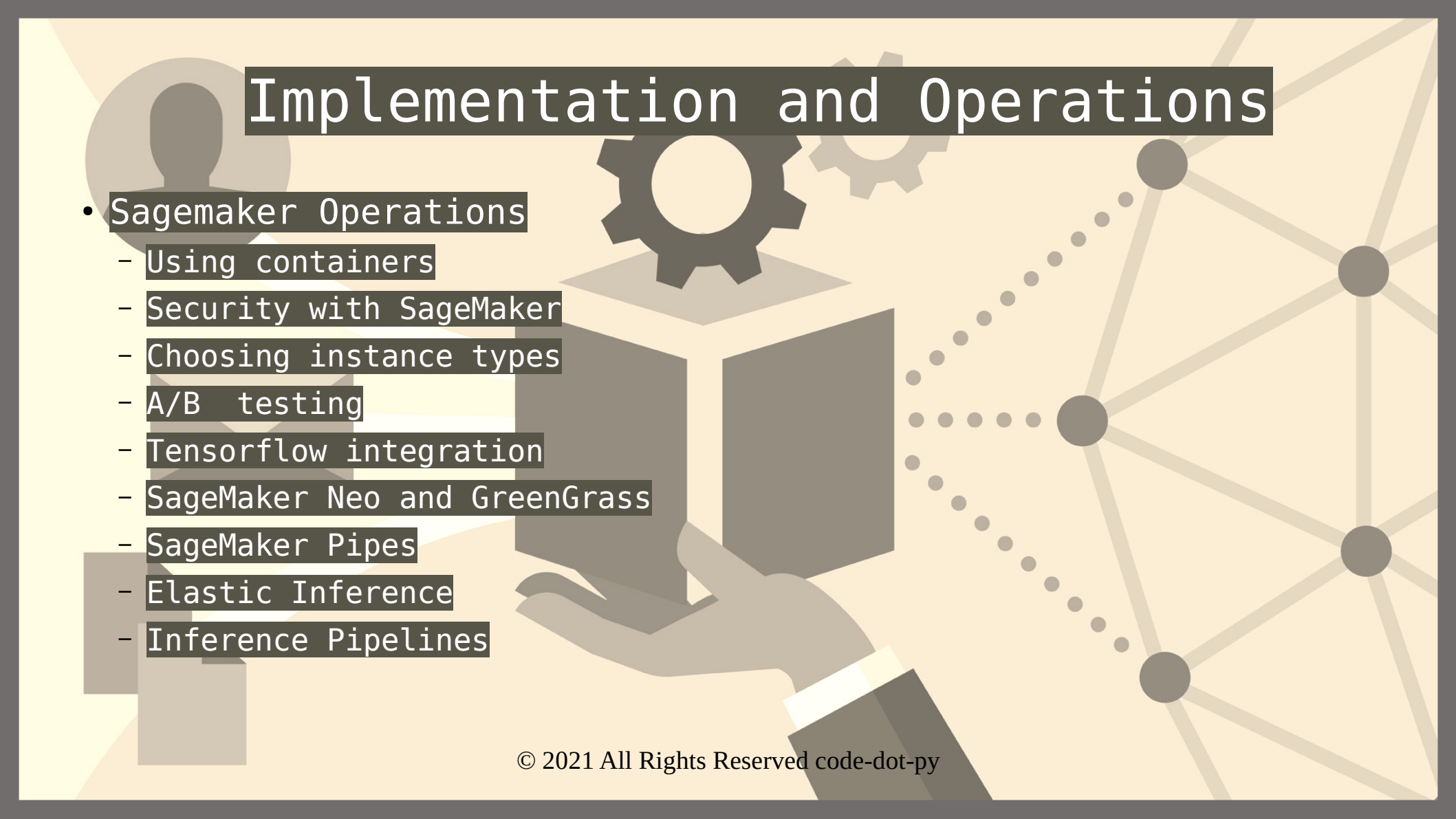
- Deep Learning
  - Multi-layer Perceptrons (MLPs)
  - Convolutional Neural Networks (CNNs)
  - Recurrent Neural Networks (RNNs)
  - ANN – Tuning and Regularization Techniques
- SageMaker
  - Architecture
  - Built-in Algorithms
  - Automatic Model Tuning
  - SageMaker Integration with other services - Spark

Modeling

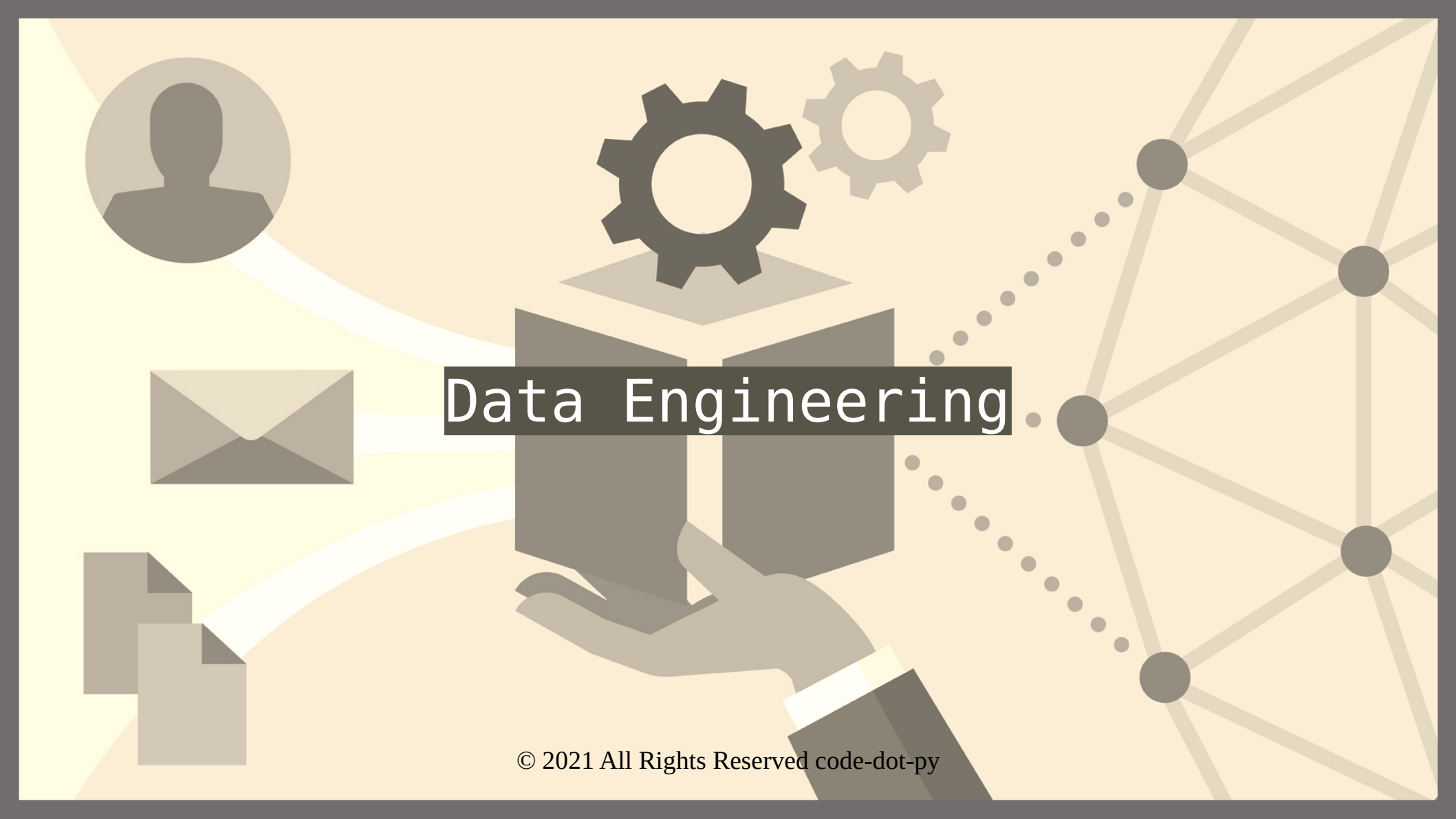
- High-level AI Services
  - Comprehend
  - Translate
  - Polly
  - Transcribe
  - Lex
  - Rekognition
  - Additional Services – Personalize, Forecast, Textract etc
  - DeepLens
- Evaluating and Tuning
  - Confusion Matrix
  - RMSE
  - Precision and Recall
  - F1 Score
  - ROC / AUC



Implementation and Operations



- Sagemaker Operations
  - Using containers
  - Security with SageMaker
  - Choosing instance types
  - A/B testing
  - Tensorflow integration
  - SageMaker Neo and GreenGrass
  - SageMaker Pipes
  - Elastic Inference
  - Inference Pipelines



AWS S3 Overview

- S3 allows for storing objects (files) in buckets (directories)
- Buckets must have a globally unique name
- The full path of the objects is called ‘Key’. Example:
  - <bucketname>/<filename>.txt
  - <bucketname>/<foldername>/<filename>.txt
- The maximum object size that can be stored: 5TB

AWS S3 for Machine Learning

- Backbone for many AWS ML services (Ex: SageMaker)
- Core service for Data Lake
  - Infinite size, no provisioning
  - 99.999999999% durability
  - S3 allows for decoupling (segregating) storage for all the compute based services. Examples:
    - EC2, Athena, Redshift, Rekognition, Glue
- Centralized Architecture – all the data at the same place
- Object Storage – supports any file format
- Common formats for ML – CSV, JSON, Parquet, ORC, Avro, Protobuf

AWS S3 Data Partitioning

- Pattern for speeding up range queries (Eg: AWS Athena)
- Partitioning Examples:
  - By Date: s3://<bucketname>/<dataset>/year/month/day/hour/<datafile>.csv
  - By Product: s3://<bucketname>/<dataset>/product-id/<datafile>.csv
- We should choose the partitioning type based on use case
- Some tools like Kinesis and Glue can help with partitioning

AWS S3 Storage Tiers

- Amazon S3 Standard – General Purpose (GP)
- Amazon S3 Standard – Infrequent Access (IA)
- Amazon S3 One Zone-Infrequent Access
  - Cheaper IA with diluted availability
- Amazon S3 Intelligent Tiering
  - New – Amazon determines where to put data to save cost
- Amazon Glacier
  - Archival

AWS S3 Storage Tiers

	Standard	Standard - Infrequent Access	One - Infrequent Access	S3 Intelligent-Tiering	Glacier
Durability	99.999999999%	99.999999999%	99.999999999%	99.999999999%	99.999999999%
Availability	99.99%	99.9%	99.5%	99.90%	NA
AZ	≥3	≥3	1	≥3	≥3
Concurrent facility fault tolerance	2	2	0	1	1

Frequently accessed | Infrequently accessed | Intelligent (new!) | Archives

S3 Lifecycle Rules

- In order to save on cost, the lifecycle rules help in moving data between different tiers
- Example:
  - General Purpose (GP) -> Infrequent Access (IA) -> Glacier
- Transition actions – Objects are transitioned to another storage class
  - Move objects from:
    - GP to IA, 60 days post creation
    - IA to Glacier 6 months post creation
- Expiration actions – S3 deletes expired objects on our behalf
  - Log files can be set to delete after a specific period of time

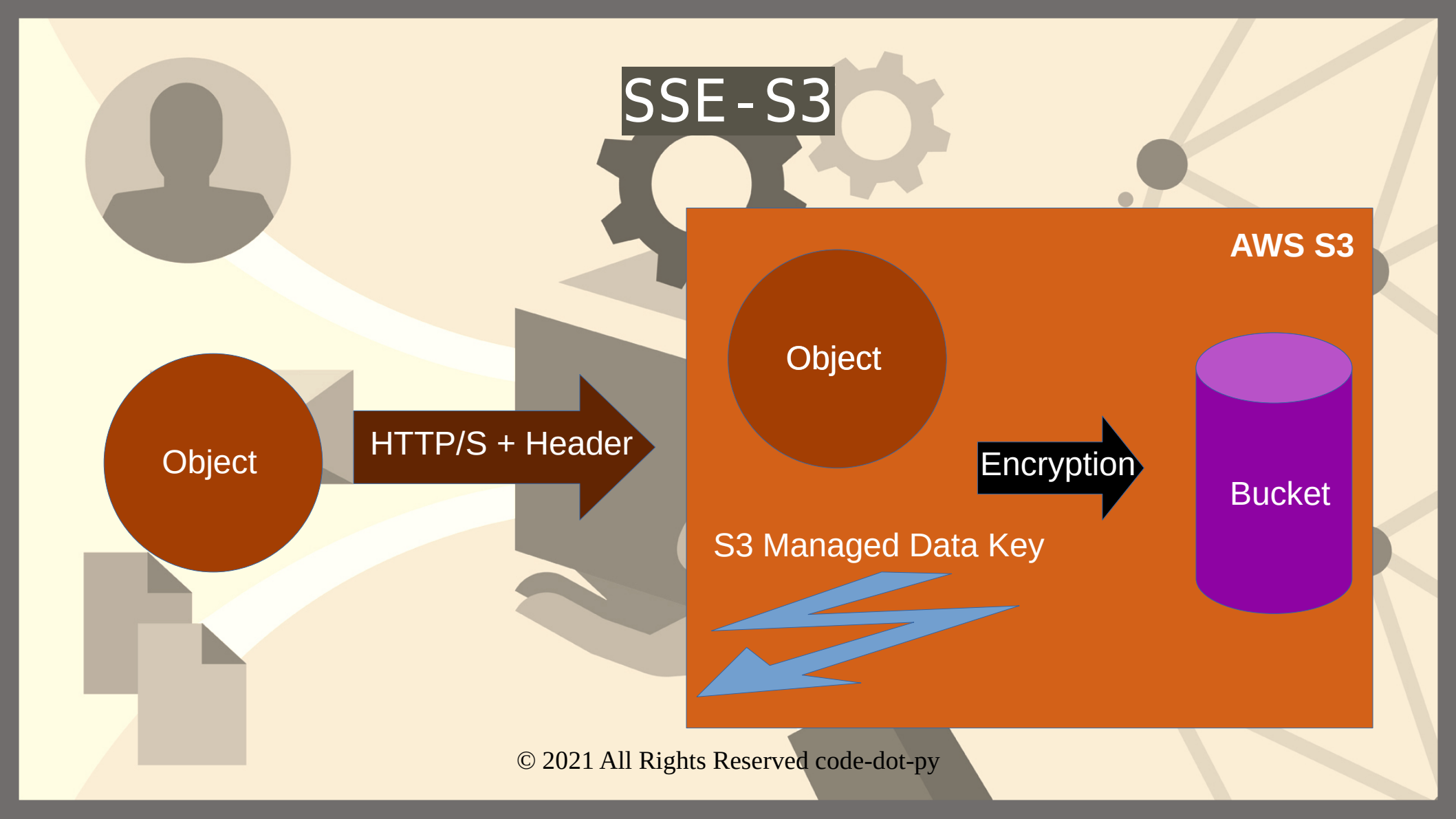
S3 Security - Encryption for Objects

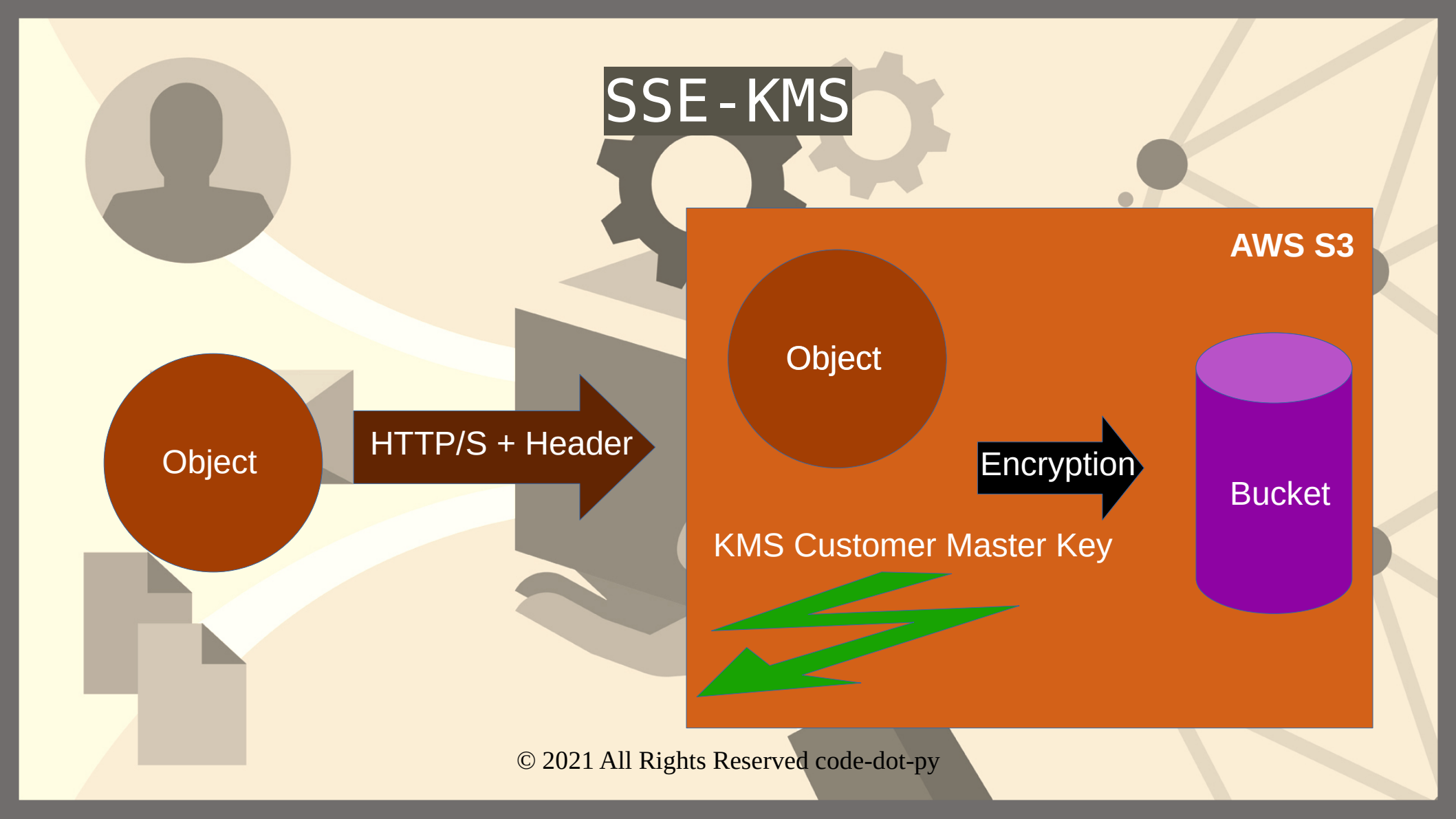
- There are four methods of encrypting objects in S3:

- SSE-S3: Encrypts S3 objects using keys handled and managed by AWS
- SSE-KMS: Use AWS key Management Service to manage encryption keys
  - Additional Security
  - Audit trail for KMS key usage

S3 Security - Encryption for Objects

- SSE-C: We need to use our own encryption keys
- Client Side Encryption
- From an ML perspective, SSE-S3 and SSE-KMS will be the most likely used scenarios





S3 Security

- User Based
  - IAM Policies – which API calls the user should be allowed
- Resource Based
  - Bucket Policy – allowing cross account access
  - Object Access Control List (ACL) – more precise control
  - Bucket Access Control List (ACL) – less commonly used

S3 Bucket Policies

- JSON based policies
  - Resources: buckets and objects
  - Actions: Set of API to Allow or Deny
  - Effect: Allow / Deny
  - Principal: The account or user to apply the policy to

S3 Bucket Policies

- Use S3 bucket policies for:
  - Granting public access to the bucket
  - For objects to be encrypted at upload
  - Grant access to another account (Cross Account)

S3 Security – Points to Remember

- Networking – VPC Endpoint Gateway
  - Allow traffic to stay within your VPC
  - Make sure the private services (Eg: SageMaker) can access S3
- Logging and Audit:
  - S3 access logs can be stored in other S3 bucket
  - API calls can be logged in AWS CloudTrail
- Tagged Based (combined with IAM and bucket policies)