AI Boot Camp

# The Impact of Machine Learning

Module 1 Day 2

Class Objectives

By the end of class, you will be able to:

1 Compare and contrast supervised and unsupervised ML.

2 Define complex AI models including neural networks, deep learning, natural language processing, and transformers.

3 Download and upload files to GitHub using the git GUI.

4 Add, commit, and push code to GitHub from the command line.

Instructor **Demonstration**
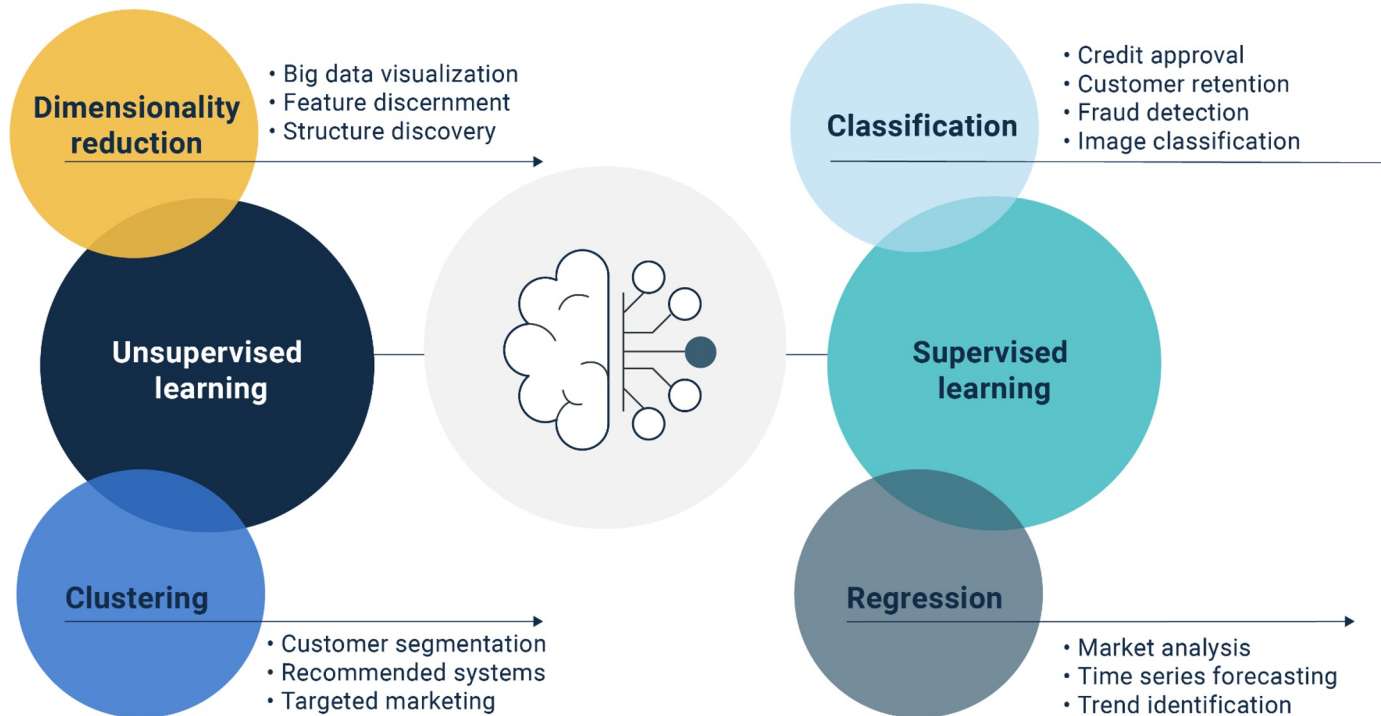
Demystifying Machine Learning
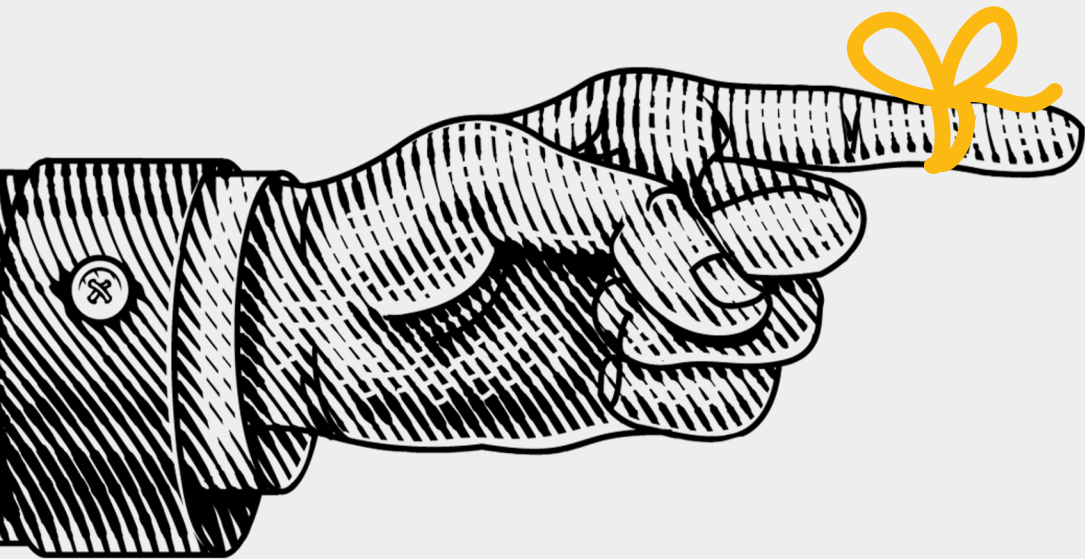
Remember,

Machine learning (ML) is the practice of applying computer algorithms and statistics to create models that can learn from data, and then make decisions or predictions about future data.

ML algorithms learn how to make decisions without needing anyone to program all that logic. They learn the patterns, behavior, and logic on their own directly from the data, and then use that knowledge to make decisions and predictions.

Types of Machine Learning

Dimensionality reduction

- Big data visualization
- Feature discernment
- Structure discovery

Unsupervised learning

Clustering

- Customer segmentation
- Recommended systems
- Targeted marketing

Classification

- Credit approval
- Customer retention
- Fraud detection
- Image classification

Supervised learning

Regression

- Market analysis
- Time series forecasting
- Trend identification

Types of Machine Learning

Supervised Learning	Unsupervised Learning
Trained with **labeled** data	Trained with **unlabeled** data
Finds relationships that help in predicting the labels in the training data	Finds relationships in the data that help distinguish data points more generally
Uses those relationships to predict which labels new points should have	Uses those relationships to add context that can assist in further analysis

Unsupervised Learning
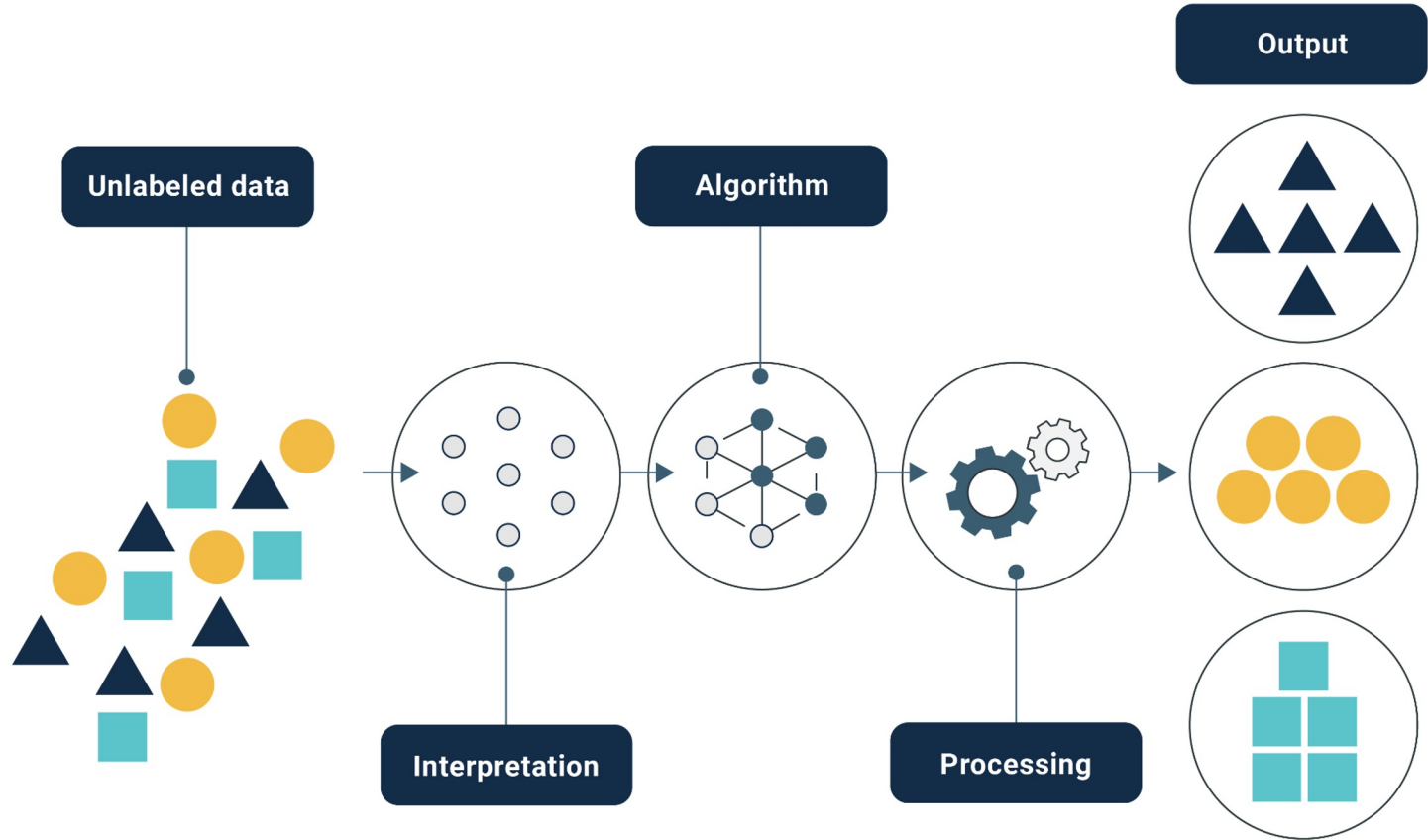
Applications of Unsupervised Learning

1 Exploratory data analysis
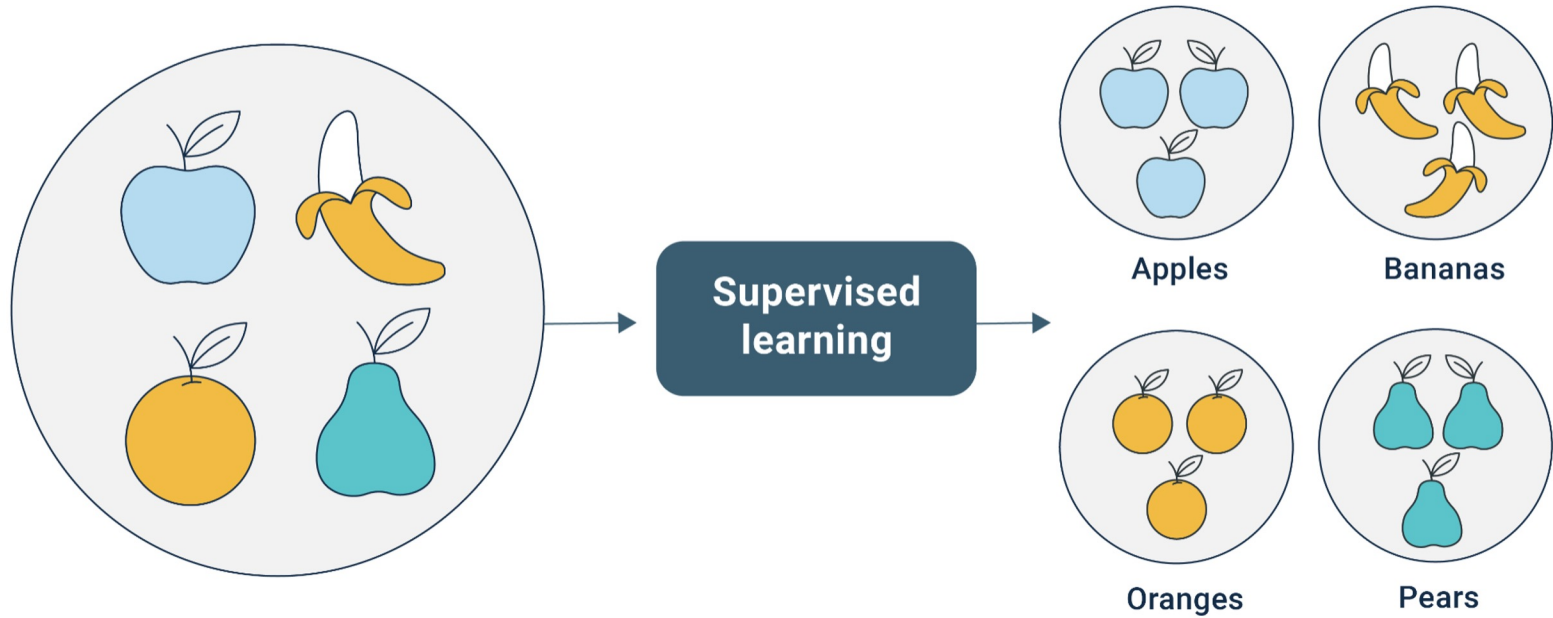
2 Cross-selling tactics

3 Consumer segmentation
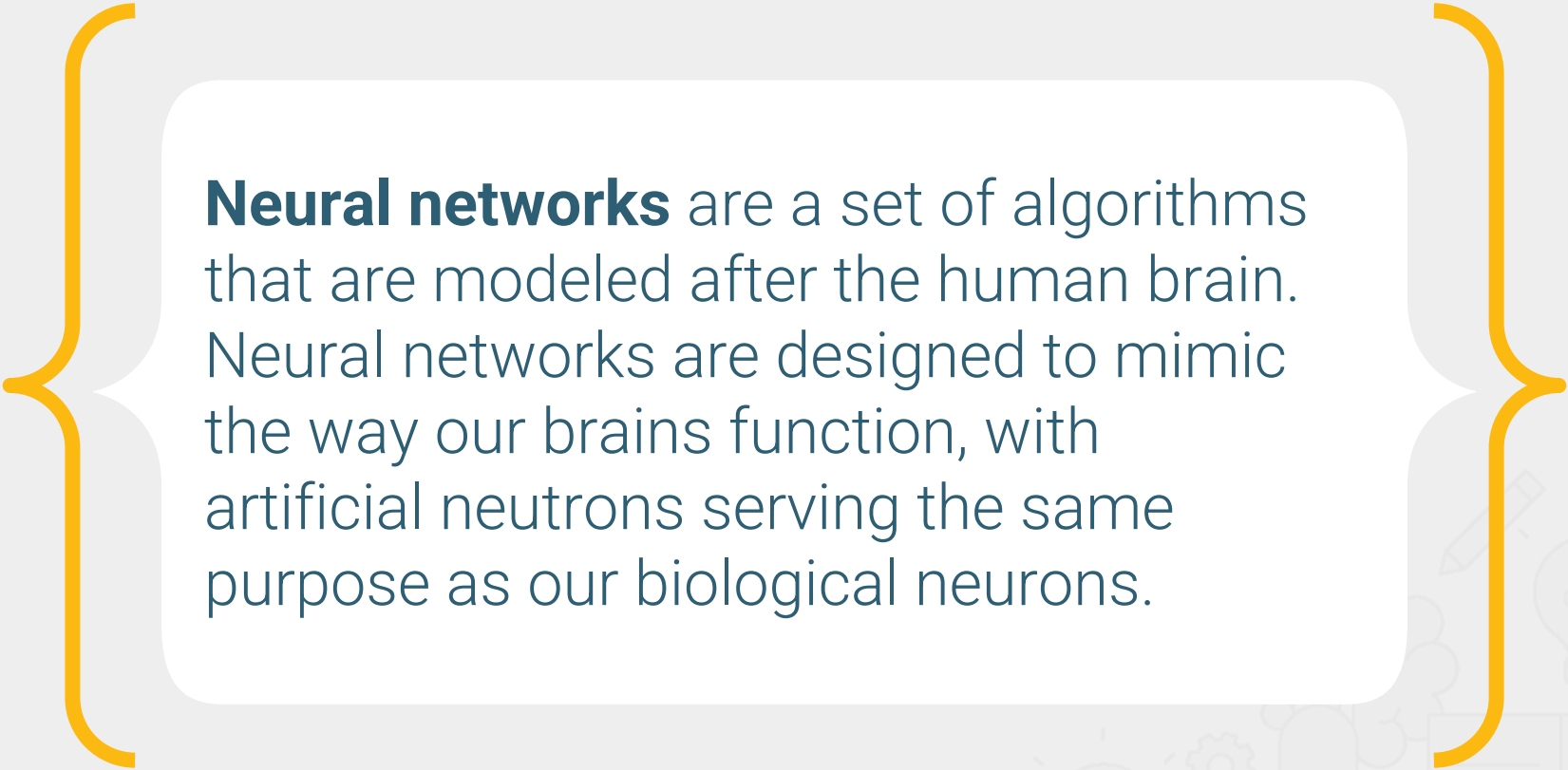
4 Pattern recognition

Supervised Learning
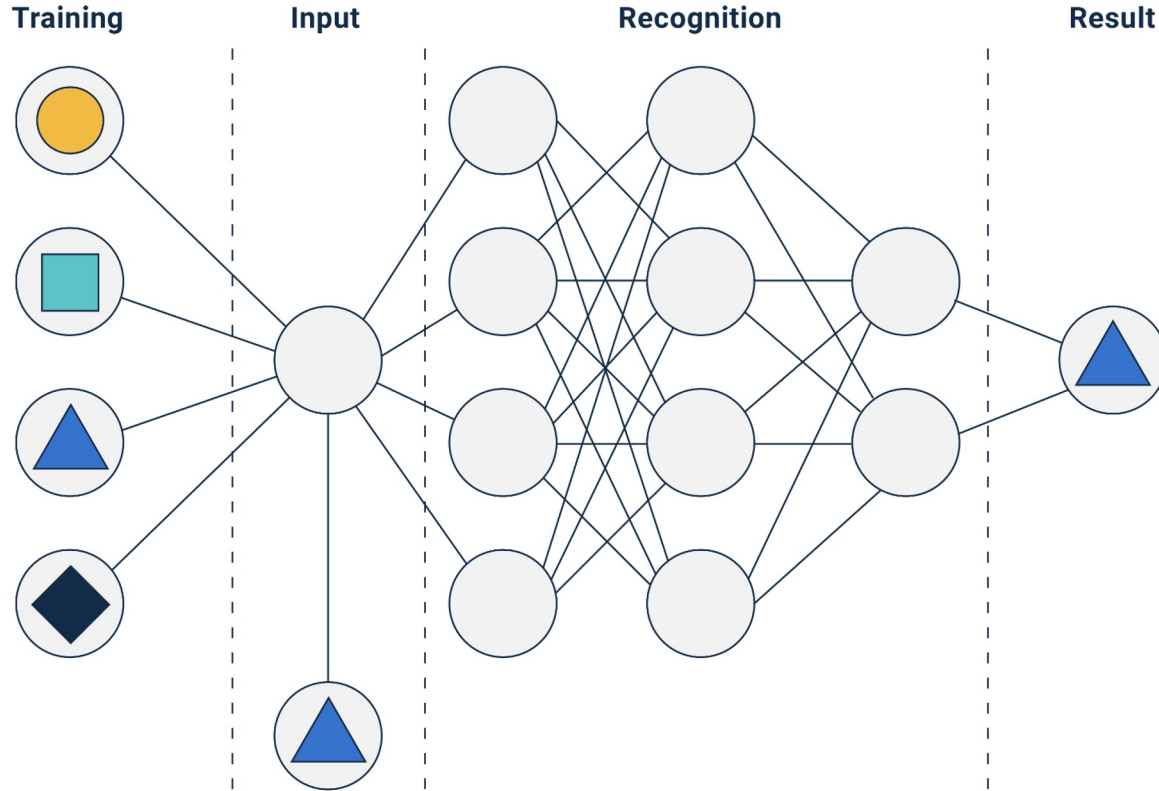
Instructor **Demonstration**

Advanced Technologies

Neural networks are a set of algorithms that are modeled after the human brain. Neural networks are designed to mimic the way our brains function, with artificial neutrons serving the same purpose as our biological neurons.

Neural Networks

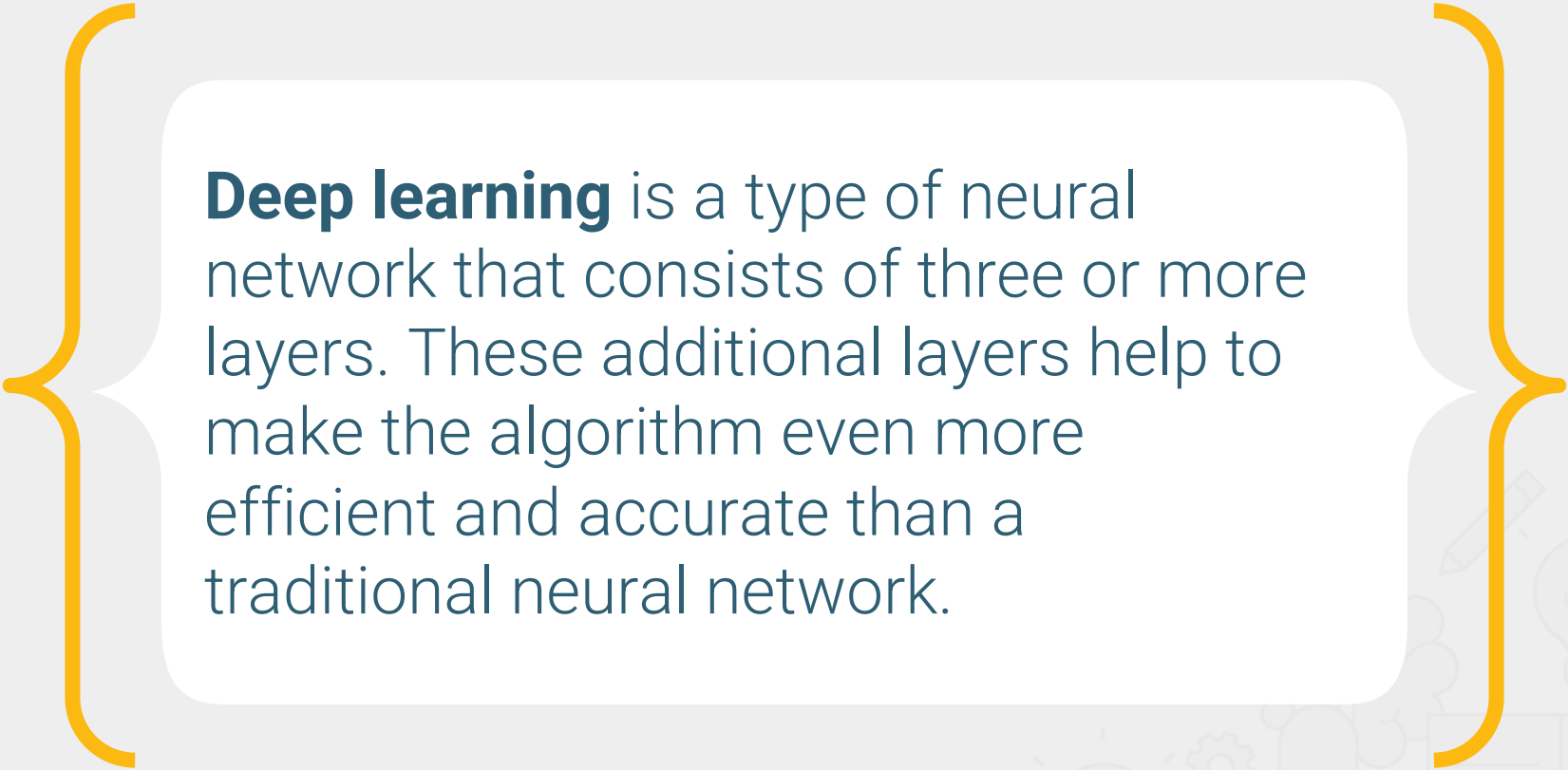
Training Input Recognition Result

Neural Networks vs. Traditional Machine Learning Models

Advantages

- Effectively detect complex relationships within data
  1. Predict consumer behavior
  2. Likelihood of default
- Greater tolerance for "messy" data

Disadvantages

- Too complex for humans to understand
  1. The "black box" problem
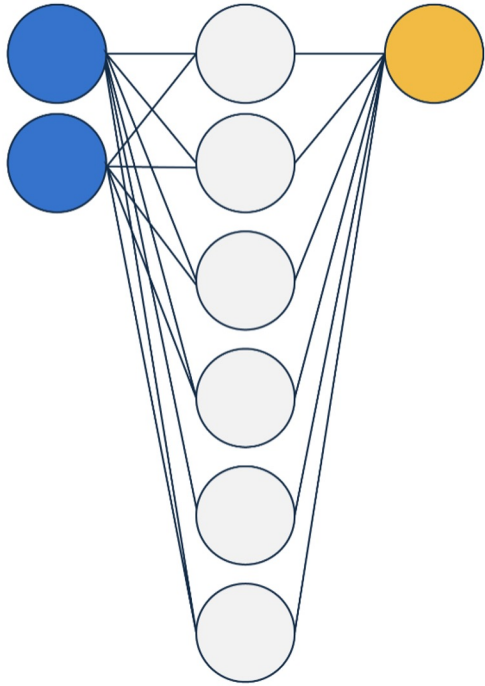- Prone to overfitting (memorization of the data)

Deep learning is a type of neural network that consists of three or more layers. These additional layers help to make the algorithm even more efficient and accurate than a traditional neural network.
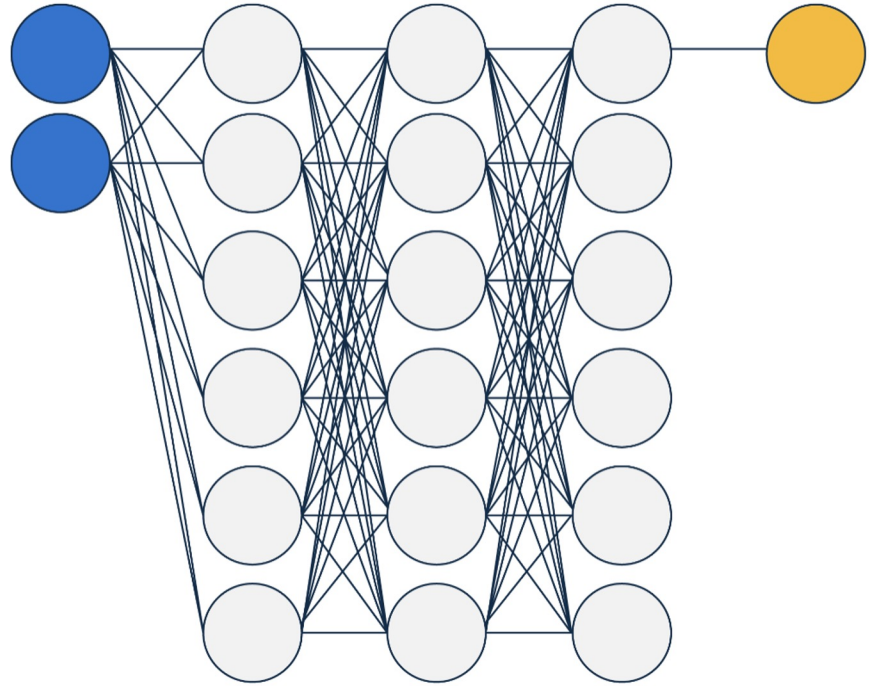
Deep Learning

Example Neural Network

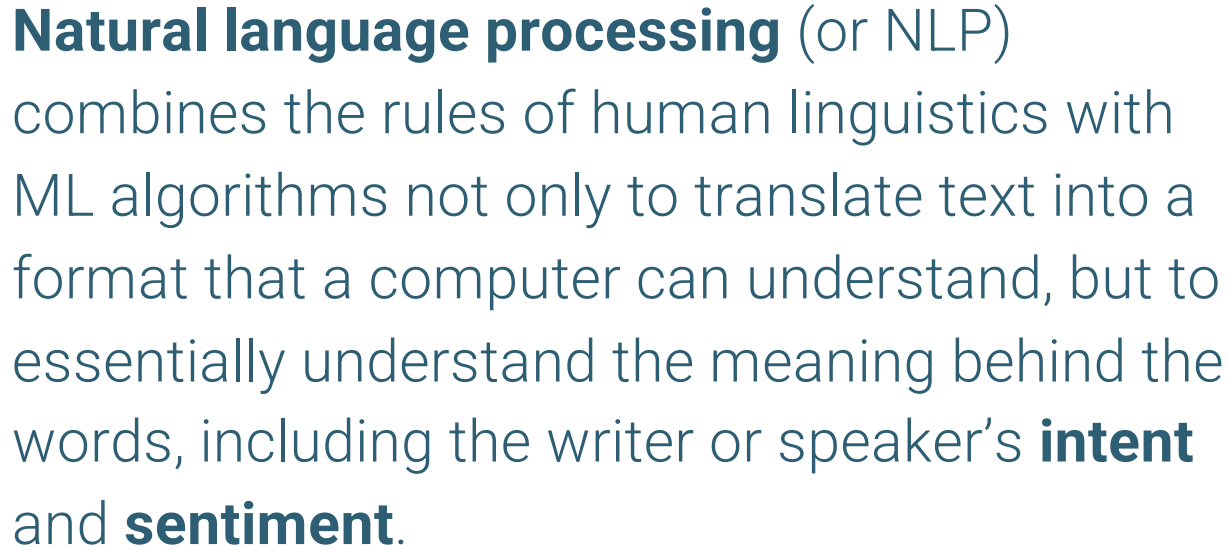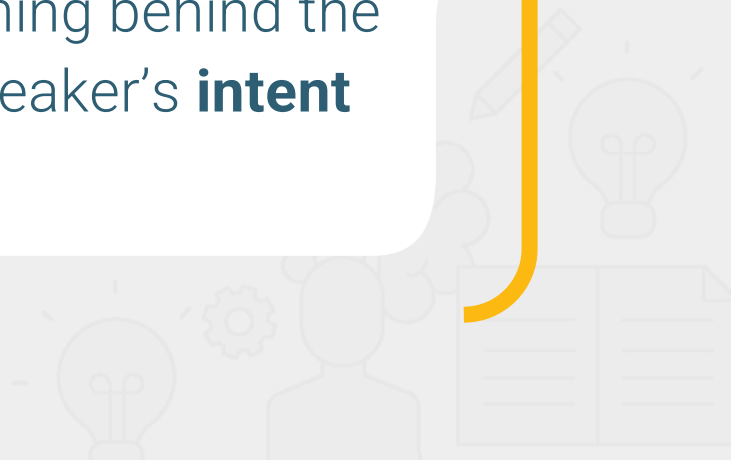In its simplest form, a neural network contains layers of neurons that perform individual computations.
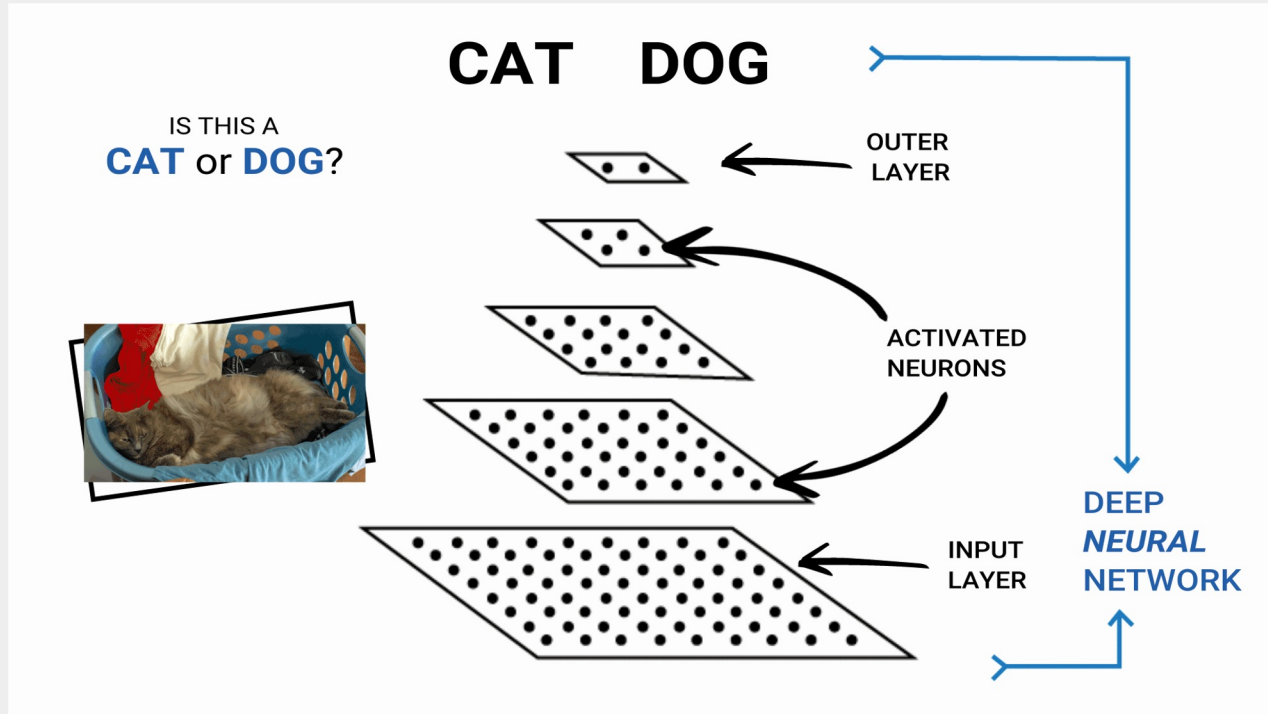
Natural language processing (or NLP) combines the rules of human linguistics with ML algorithms not only to translate text into a format that a computer can understand, but to essentially understand the meaning behind the words, including the writer or speaker's **intent** and **sentiment**.

A **large language model** is a type of "deep learning algorithm that can recognize, summarize, translate, predict and generate text and other forms of content based on knowledge gained from massive datasets."

— **Lee, A.** 2023. *What are large language models used for?* [Blog, 26 January]. Available: https://blogs.nvidia.com/blog/2023/01/26/what-are-large-language-models-used-for/ [2023, April 6].

"A **transformer model** is a neural network that learns context and thus meaning by tracking relationships in sequential data like the words in this sentence."

— **Merritt, R.** 2022. *What is a transformer model?* [Blog, 25 March].
Available: https://blogs.nvidia.com/blog/2022/03/25/what-is-a-transformer-model/ [2023, April 5].

Transformer Model Process

1 Text or spoken words are fed into the algorithm which extracts the data and breaks each element into individual words or phrases through a process called **tokenization**.

2 The algorithm classifies and labels each element.

3 Using statistical training, the algorithm proposes the *most likely* meaning of the data.

Applications of NLP Models

1. Distinguishing spam from legitimate emails

2. Translating from one language to another

3. Social media sentiment analysis

4. Chatbots and virtual agents

Instructor **Demonstration**

Machine Learning is Awesome

Instructor **Demonstration**

AI Foundations

AI Foundations

Today's AI Foundations section will cover GitHub, the industry-standard collaboration tool.

1 You will use GitHub to store your code, collaborate with your peers on projects, and submit assignments.

2 Your first Challenge assignment will be creating a repo with GitHub.

3 Getting comfortable with Git and GitHub is critical for your success in the boot camp and post-graduation. Invest the time now to get to know it well.
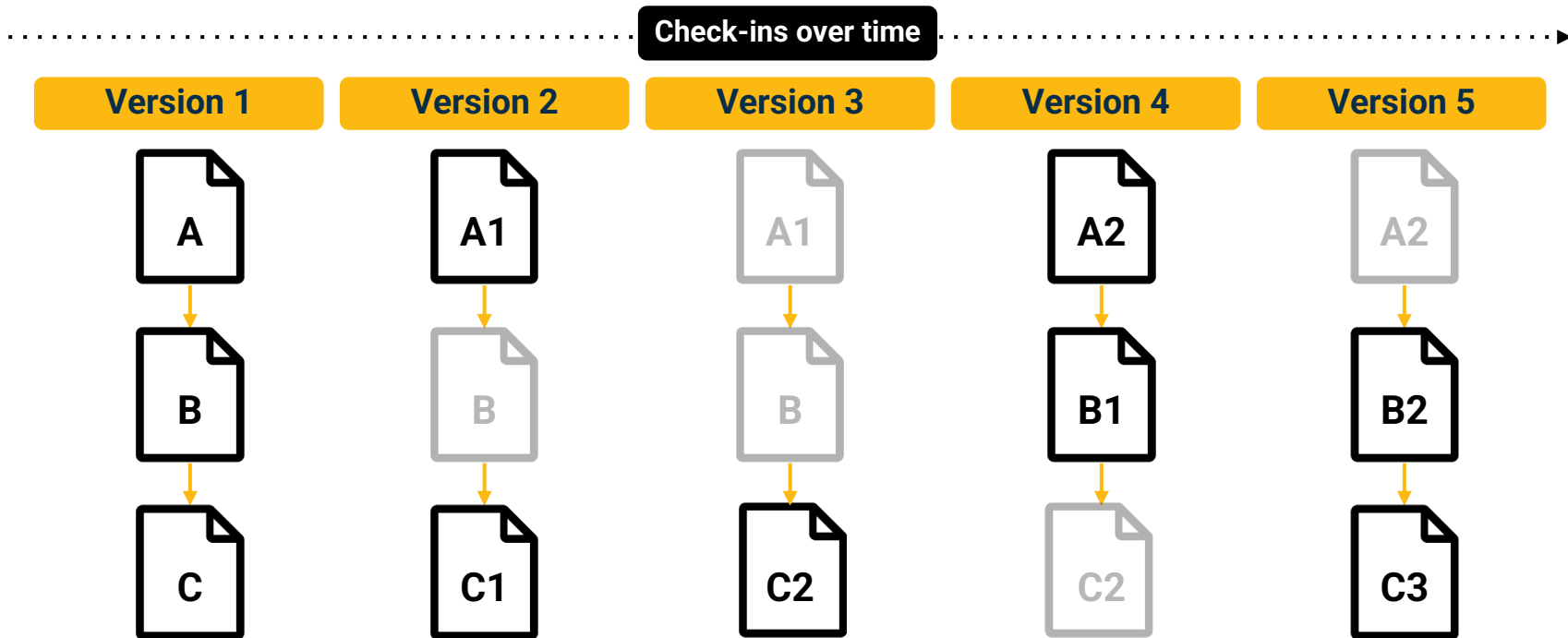
Instructor **Demonstration**

Intro to Git

Intro to Git

Git is a way for us to keep track of our work over time. Whenever we get another piece of a project working, we can save the change with Git.

Dear Git,

I made some changes
to these files:
1. ▬▬▬▬▬▬▬▬▬
2. ▬▬▬▬▬
and here is why

▬▬▬▬▬▬▬▬▬▬

▬▬▬▬▬▬▬▬▬▬

▬▬▬▬▬▬▬▬▬▬
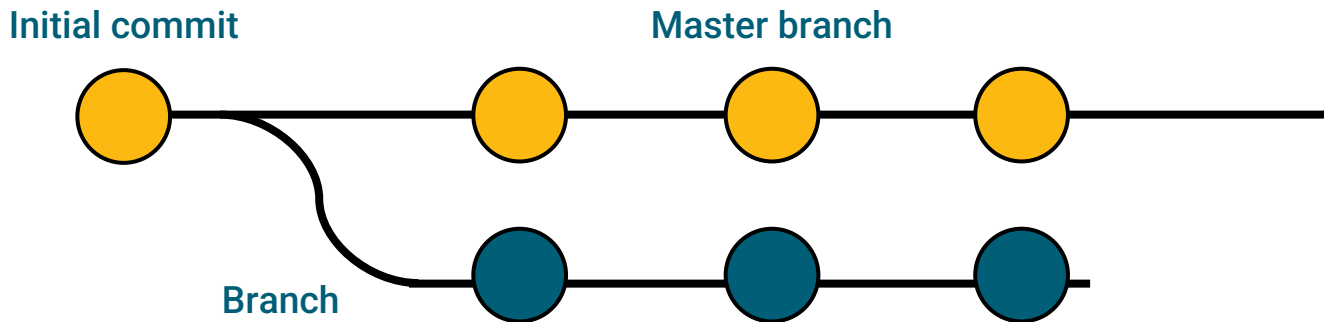
Git Commit

A Git "save" is called a commit. It represents a checkpoint for our project where we save and describe our work.

Initial commit

Master branch

Branch

If we break something while working on our code, this system allows us to restore working code from earlier. Since Git remembers these checkpoints, we can work on several different concerns all at once.

Popular Git Commands

git clone	Clones a Git repository onto the local file system
git add	Adds changed files to the queue of tracked files ready to be committed
git commit	Adds tracked files as a bulk checkpoint ready to be pushed to the remote Git repository
git push	Uploads changed files from the local Git repository to the remote Git repository and updates the remote files
git pull	Downloads changed files from the remote Git repository to the local Git repository and updates the local files

A commit in GitHub is like a snapshot of what your project or file looks like at a particular moment in time. If a file doesn't contain any changes, the file is not stored again; instead, Git provides a link to the identical file that it previously stored.

Break

15 mins

Activity:
Create a Repository

In this activity, you will get some additional practice creating a repository via the terminal.
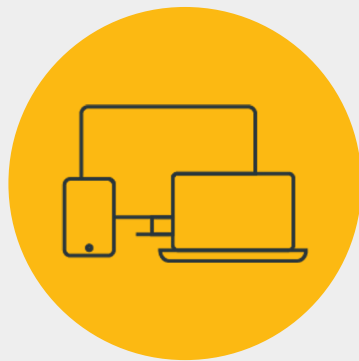
1. Create the repository

2. Clone the repository

3. Add and edit files

4. Stage and commit changes

5. Push local changes to remote repository

Suggested Time:

15 Minutes

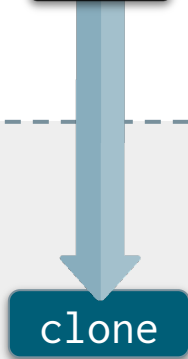# Time's up!
Let's review

Instructor **Demonstration**

Branching
Pull Requests and Code Review

Git Version Control

Scenario: Your group has been working with Uber's rider data, and you've decided to analyze the average age of the riders.

The root code for the project is called `main`.

Main

Version 1
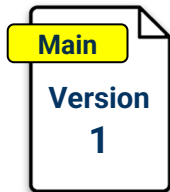
Remote repository

The **staging area** is where you edit the files that will be part of the next commit.

Staging area

`clone`

This takes an existing GitHub repository, downloads it to the local computer, and links it to GitHub.

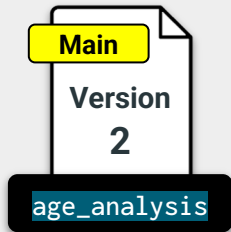# Git Version Control

Git essentially allows us to write this code and save it with the name `age_analysis`.

Remote repository

Main
Version
1

The **staging area** is the where you edit the files that will be part of the next commit.

Staging area

Main
Version
2

`age_analysis`

`git commit` ✅

Your staged changes are saved once you commit.

Working directory

Git Version Control

`age_analysis` is a branch that originates from the main branch. It contains updates that will be added to the main branch when it's ready to `merge`.

Remote repository

Version 1

Version 2

`age_analysis`

The **staging area** is the where you edit the files that will be part of the next commit.

Staging area

Main

Version 2

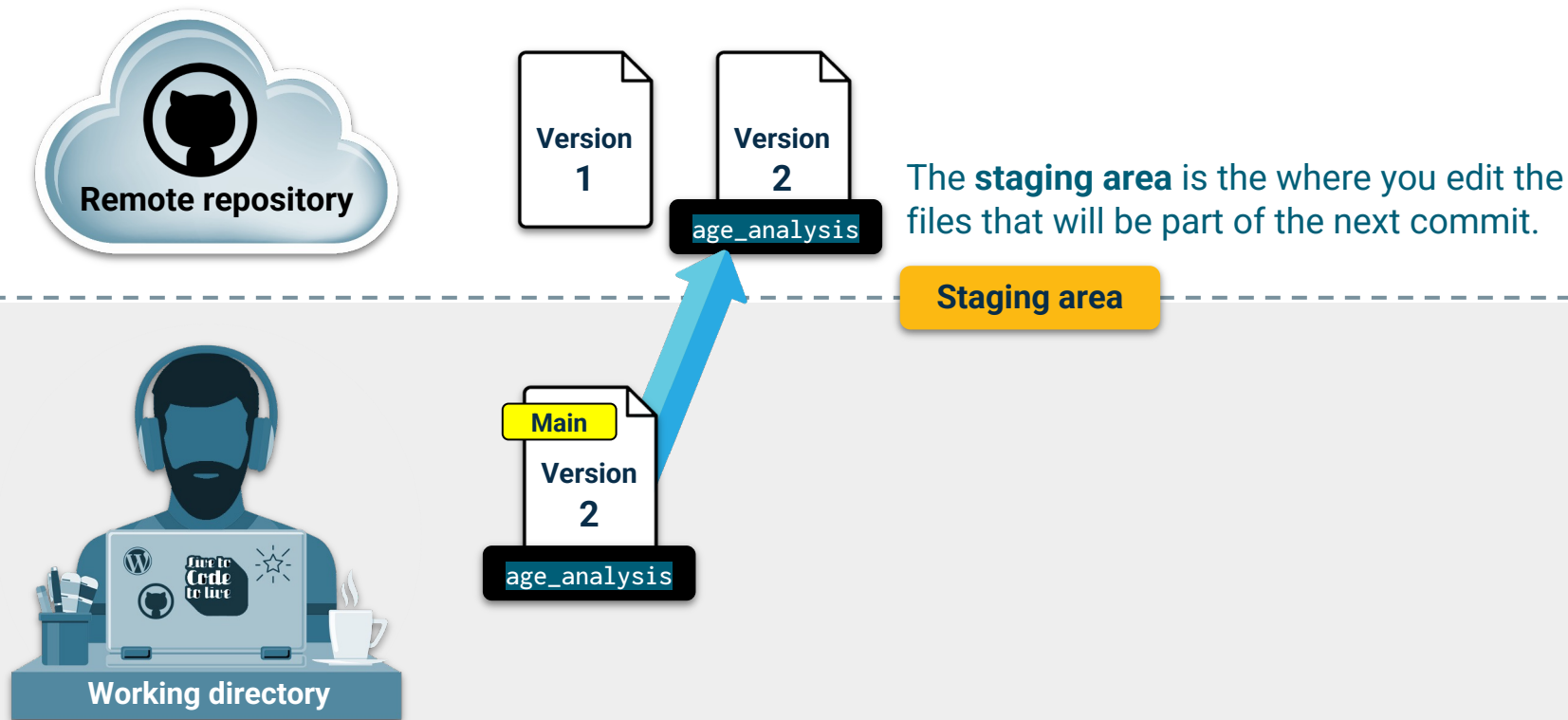`age_analysis`

Working directory

Git Branching

1 Every Git repo starts off with a main branch, which is there to hold the production version of the repo's code. But when we want to work on the code, we start by creating a new feature branch off the main.

2 If we create a new branch from the main, we essentially create a self-contained copy of all of the main branch code for us to work in.

3 When we're satisfied with our work in the new feature branch, we submit a pull request from the feature branch to the main branch.

4 A pull request is a request to merge the diffs or changes from the source branch (the feature branch) to the target branch (main).
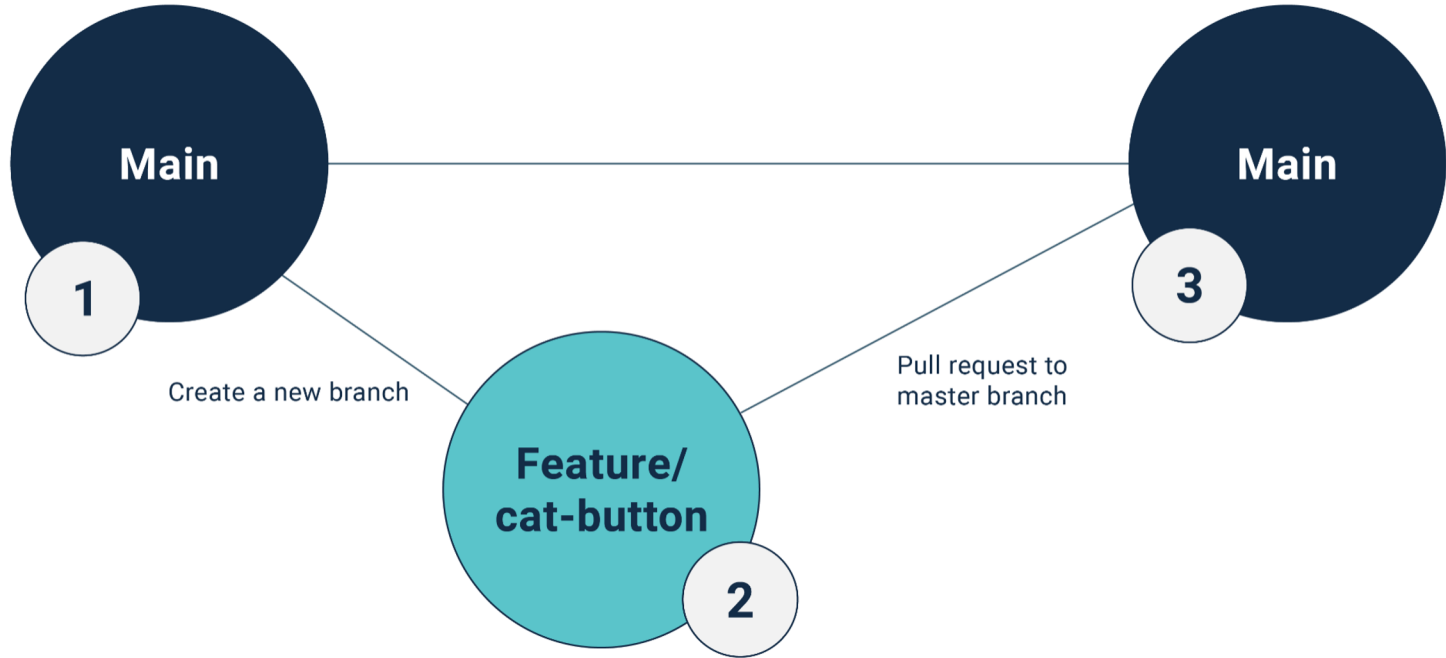
Git Branching

5 With the way our repos are set up now, another group member must look at and approve the pull request before its changes can be merged into the main.

6 Once a feature branch has been merged into the main, we delete it and then check back out to the main branch. From there, we'd check back out to a new feature branch, and repeat the process for each feature we add.

Git Branching

Main   1

Feature/cat-button   2

Main   3

Create a new branch

Pull request to master branch

Activity:

Git Branching, Pushing

In this activity, you will create branches, submit pull requests, and perform code reviews before merging.

Suggested Time:

15 Minutes

Time's up!
Let's review

Activity:
Protect Main Branch

In this activity, you will protect your main branch and then perform your own file system operations via the command line.

(Instructions sent via Slack.)
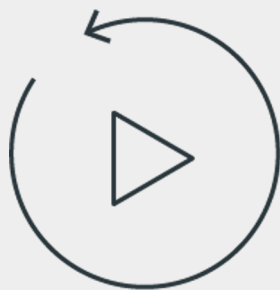
Suggested Time:

10 Minutes

Time's up!
Let's review

Questions?

Let's **recap**

Recap

After today's lesson you are able to:

1   Compare and contrast supervised and unsupervised learning.

2   Define complex AI models including neural networks, deep learning, natural language processing, and transformers.

3   Download and upload files to GitHub using the git GUI.

4   Add, commit, and push code to GitHub from the command line.

Next

In the next lesson, you'll engage in a series of activities, from brainstorming about your personal interactions with AI to investigating its transformative effects across diverse sectors. You'll also get your hands on practical AI tools like Anaconda, the command line, and GitHub.

The End