DATASCI207-005/007 Applied Machine Learning

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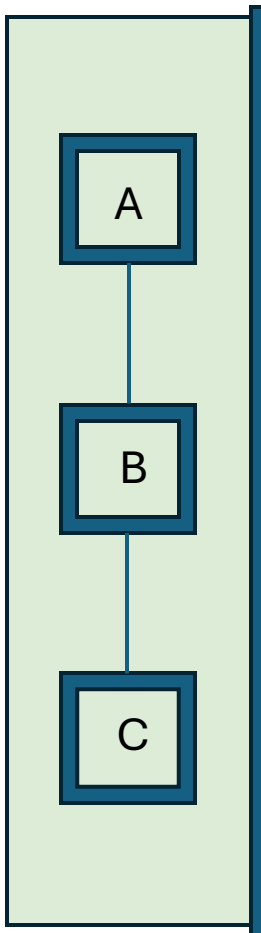
Week 11: 03/19/2025 – 03/20/2025

Today's Agenda

- Network Architecture Design
- Walkthroughs:
  - Network Architecture Design Examples

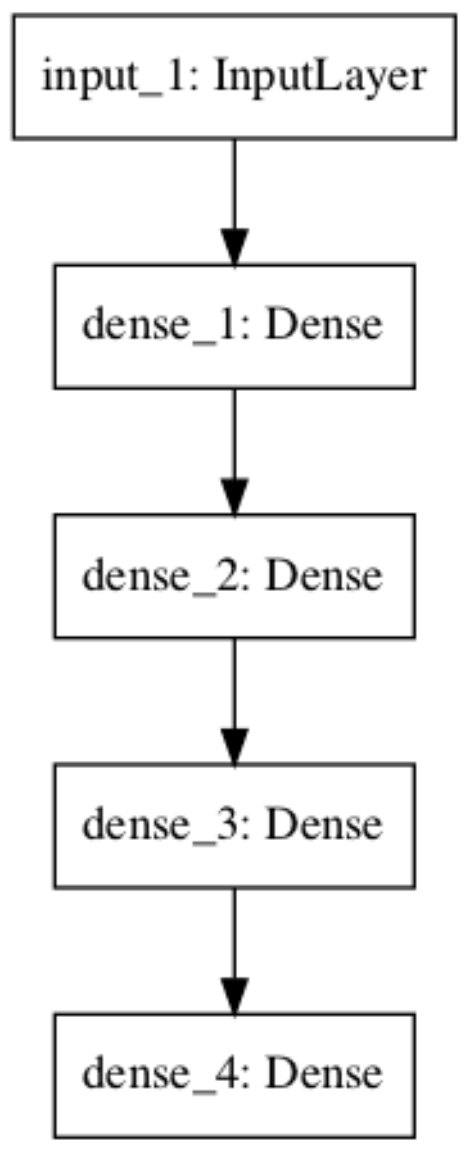
TensorFlow/Keras: Sequential vs. Functional API

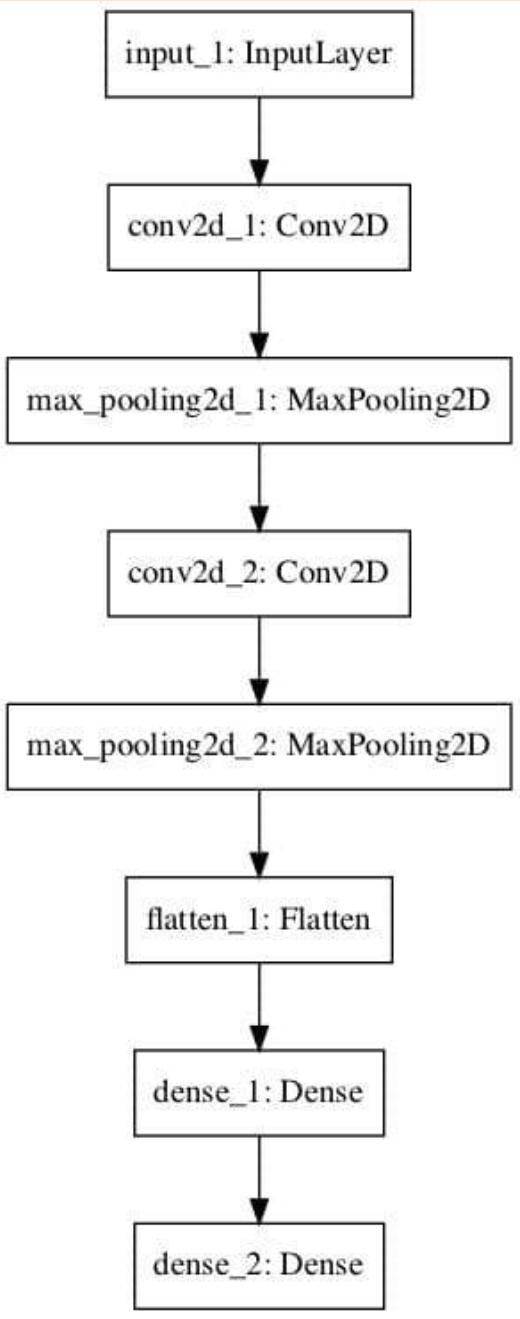


Can we do better?
Do we have a more flexible toolbox/approach to build NN models?

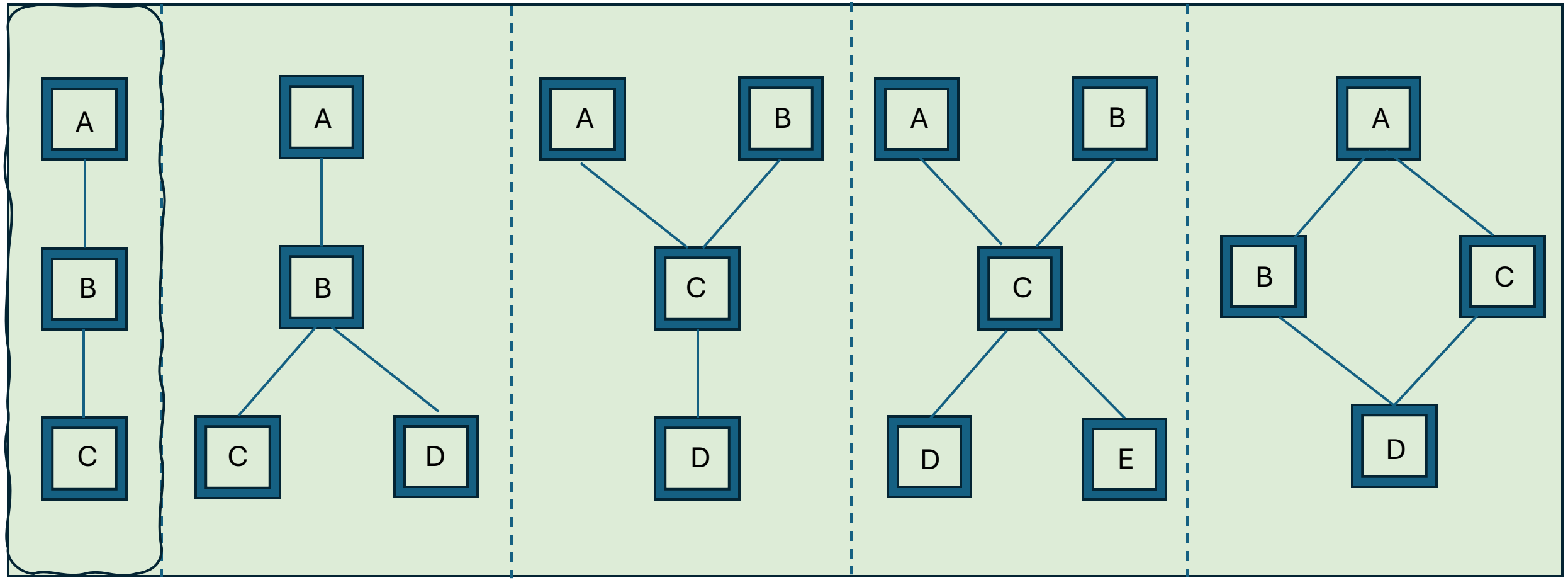
A deep learning model: usually a directed acyclic graph (DAG) of layers
Functional API: a way to build graphs of layers

Sequential API





Sequential vs. Functional API



Sequential to Functional API

Practice

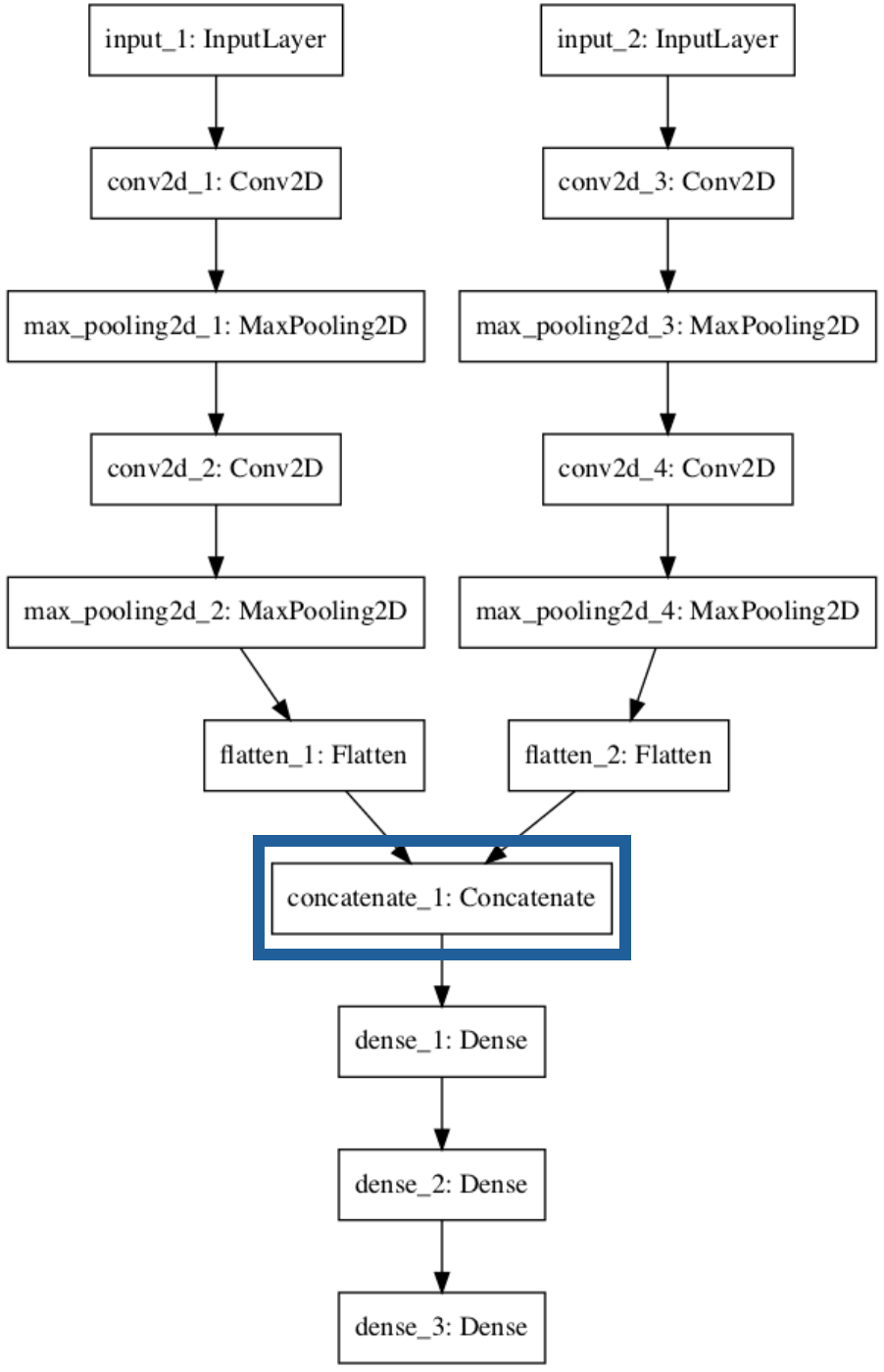
Functional API

Example

- An **image classification** model
  - Input:
    - two versions of the image (different sizes)
      - a black and white 64×64 version
      - a color 32×32 version
  - Output:
    - Independent feature extraction CNN models operate on each image version
    - results from both models are concatenated for interpretation and prediction

Multi-Input, One-Output

- Independent feature extraction
- CNN models operate on each image version



Ref.: Jason Brownlee, Machine Learning Mastery

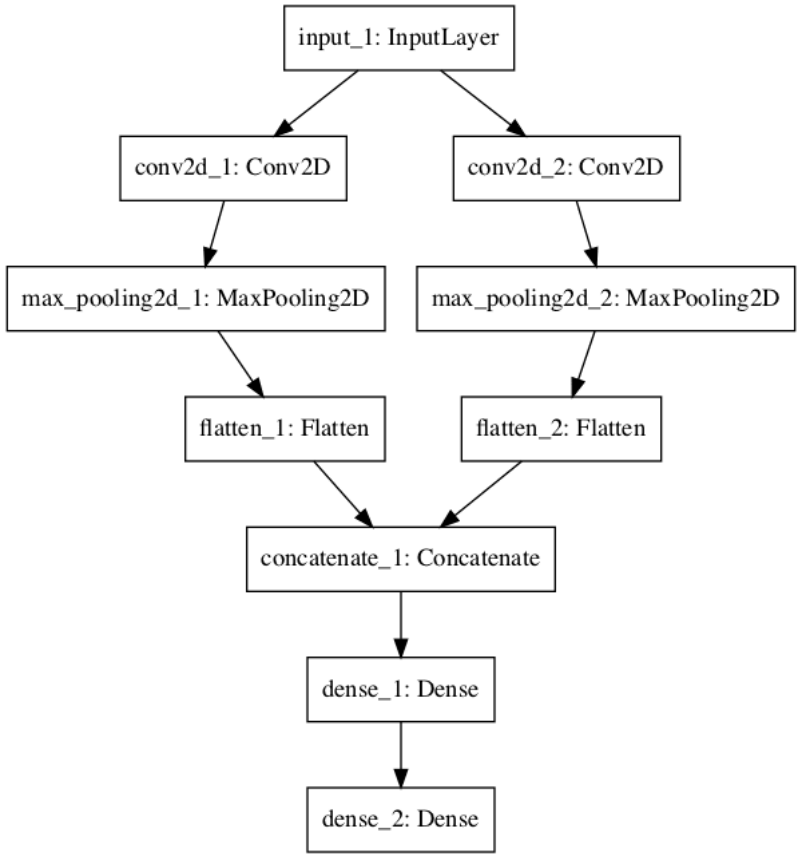
Functional API

Example

- Input:
  - black and white images: 64×64 pixels
- Two CNN feature extraction submodels
  - share input
  - Model 1: kernel size of 4
  - Model 2: kernel size of 8
- Outputs:
  - Flattened into vectors
  - Concatenated into one long vector, pass to a fully connected layer
  - binary classification

Ref.: Jason Brownlee, Machine Learning Mastery

Shared Input Layer

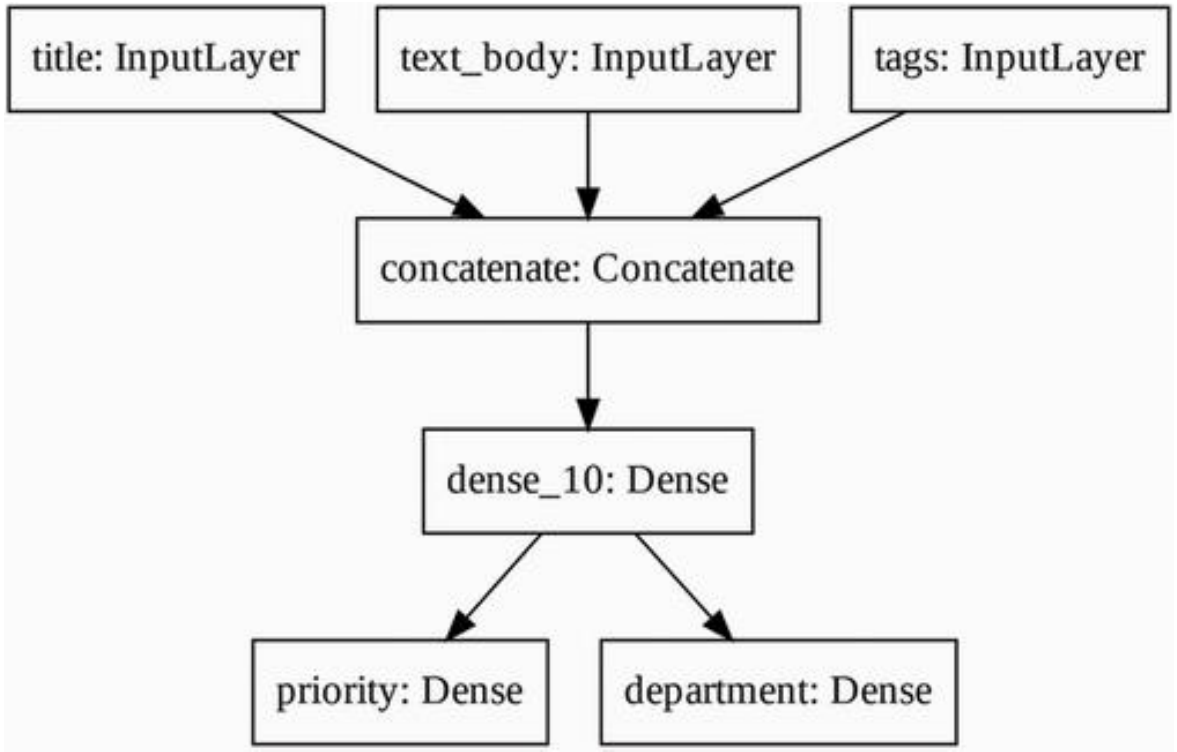


Functional API

Use-Case

- Rank customer support tickets by priority and route them to the appropriate department
- Inputs:
  - The title of the ticket (text input)
  - The text body of the ticket (text input)
  - Any tags added by the user (categorical input, assumed here to be one-hot encoded)
- Outputs:
  - The priority score of the ticket, a scalar between 0 and 1 (*sigmoid* output)
  - The department that should handle the ticket (a *softmax* over the set of departments)

Multi-Input, Multi-Output



Ref.: Deep Learning with Python, Second Edition, Francois Chollet

Functional API

Practice