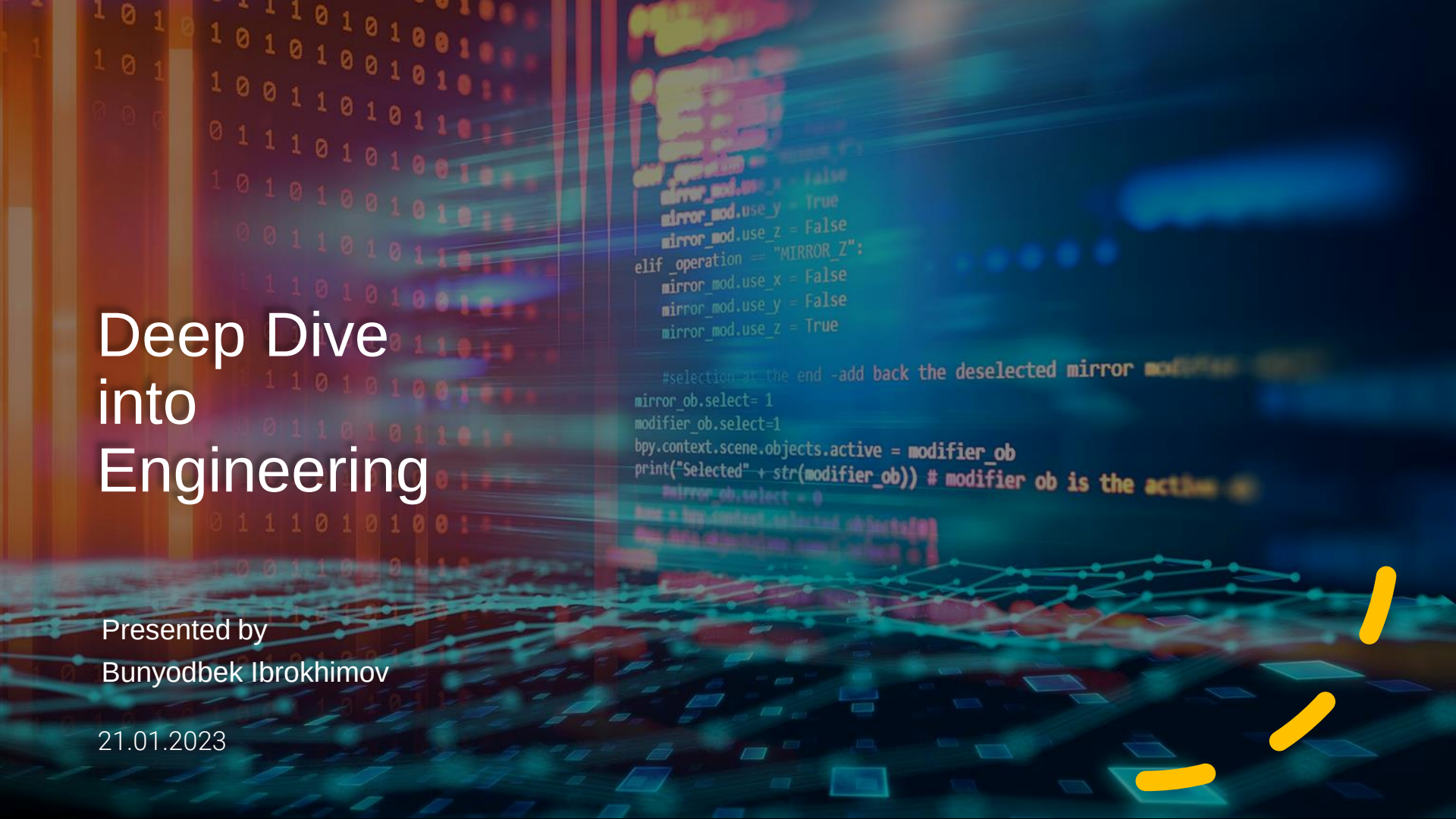


Deep Dive into Engineering

Presented by

Bunyodbek Ibrokhimov

21.01.2023

Agenda

01

What is software engineering?

02

Where to start:
A Roadmap

03

Different levels of software engineer

04

Tips to become a pro

Software Engineering

ChatGPT

Software engineering:
The design and development of software systems, including the use of programming languages, software development methodologies, and software testing.

From coding to ML engineer

Computer engineering:
Software Engineering +

- **Computer architecture**: The design and organization of computer systems, including the design of processors, memory systems, and other components.
- **Computer networks**: The design, implementation, and maintenance of computer networks and communication systems, including local area networks (LANs), wide area networks (WANs), and the internet.
- **Embedded systems**: The design and development of computer systems that are integrated into other devices or products, such as cars, appliances, and medical equipment.

Where to start: A Roadmap

Programming language

Python
- Syntax
- Basics (variables, data types, casting)
- Loops, iterators, scope, modules, function

Algorithms and data structures

- **Sequence of instructions**
- **A process or set of rules**

- Dictionaries
- Linked lists
- Binary search tree
- Arrays, Lists, Sets

Core ML/DL concepts

- Matrix multiplication
- Neural network structure (layers)
- Inference
- Backpropagation
- Activation functions
- Error functions
- Regularizations

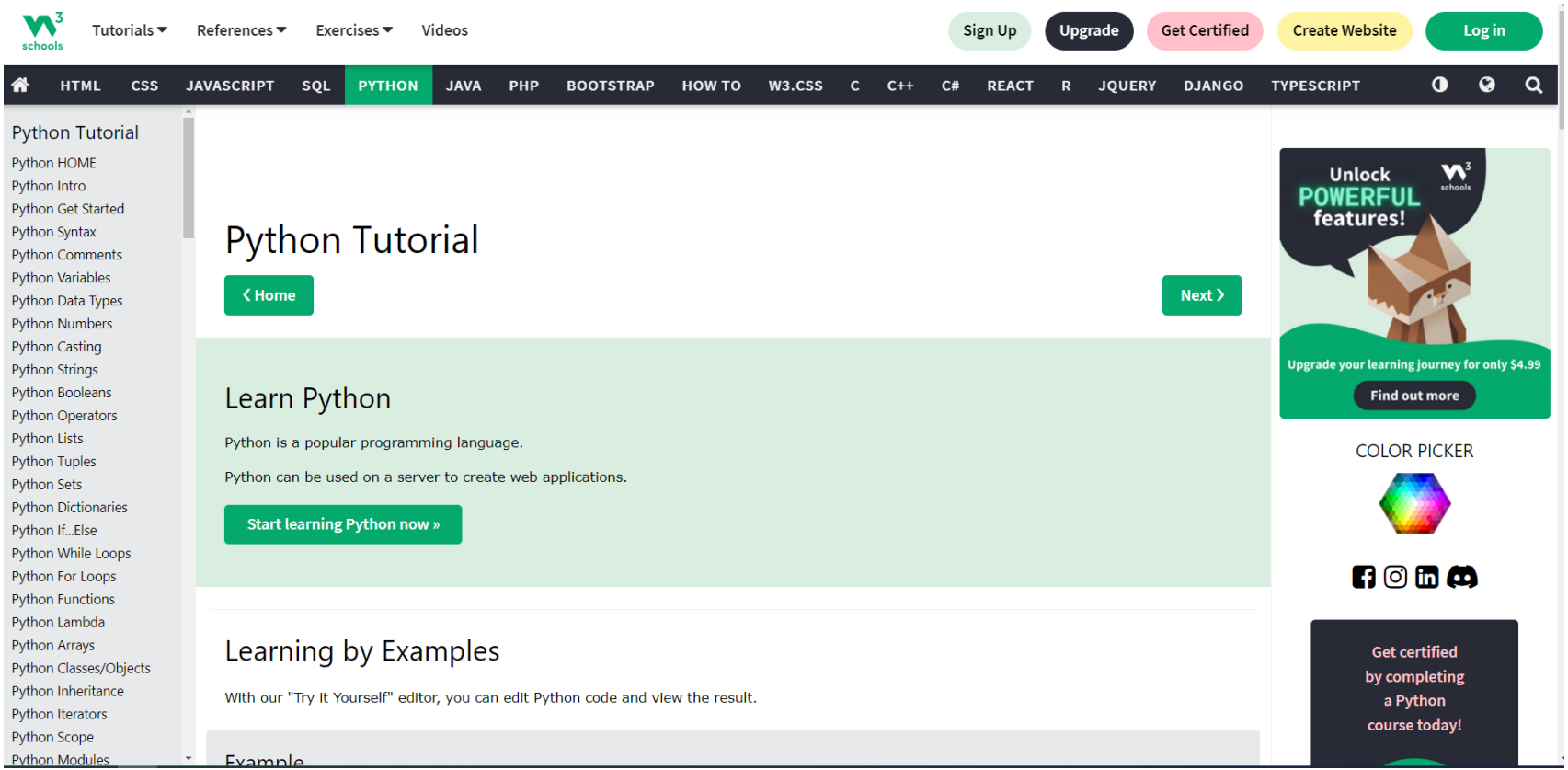
Tools and frameworks

- Pytorch
- Tensorflow
- Keras

- Pandas
- NumPy
- Matplotlib
- OpenCV
- ROS

- Git/GitLab
- Linux

Python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Python Sets
Python Dictionaries
Python If...Else
Python While Loops
Python For Loops
Python Functions
Python Lambda
Python Arrays
Python Classes/Objects
Python Inheritance
Python Iterators
Python Scope
Python Modules
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Find out more
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Get certified by completing a Python course today!

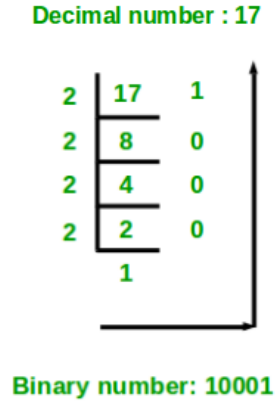
Python

- YouTube
- Coursera
- Udemy
- Codecademy
- Codefinity (from zero to hero)
- W3Schools

Algorithm

- **Covert Decimal (17) to binary (10001)**
- **Valid palindrome**
- **Remove zeros from string**
- **…**

1 read (number)
2 loop (number > 0)
  1 digit = number modulo 2
  2 print (digit)
  3 number = number / 2



test.cpp

```cpp
void decToBinary(int n){
    int binaryNum;
    int i = 0;
    while (n > 0) {
        binaryNum[i] = n % 2;
        n = n / 2;
        i++;
    }
    for (int j = i - 1; j >= 0; j--)
        cout << binaryNum[j];
}
int main(){
    int n = 17;
    decToBinary(n);
    return 0;
}
```

```python
def decToBinary(n):
    binaryNum = [0] * n
    i = 0
    while (n > 0):
        binaryNum[i] = n % 2
        n = int(n / 2)
        i += 1
    for j in range(i - 1, -1, -1):
        print(binaryNum[j], end = "")
n = 17
decToBinary(n)
```

Algorithm

- **Covert Decimal (17) to binary (10001)**
- **Valid palindrome**
- **Remove zeros from string**
- **…**

```
Input : malayalam
Output : Yes

Input : geeks
Output : No
```

Integer: 1221

1221 // 1000 == 1221 % 10
1221 // 100 == 1221 % 100
1221 // 10 == 1221 % 1000

127809721

```python
def isPalindrome(str):
    for i in range(0, int(len(str)/2)):
        if str[i] != str[len(str)-i-1]:
            return False
    return True

s = "malayalam"
ans = isPalindrome(s)

if (ans):print("Yes")
else:print("No")
```

```python
def isPalindrome(s):
    return s == s[::-1]

s = "malayalam"
ans = isPalindrome(s)

if ans:print("Yes")
else:print("No")
```

Time complexity: O(n)
Auxiliary Space: O(1)

Data structure

- **Search from sorted array**

Input: arr = [-1,0,3,5,9,12], target = 9
Output: 4

```python
arr = [-1,0,3,5,9,12]
target = 13
def search(target):
    for i in range(len(arr)):
        if arr[i] == target:
            return(i)
    return -1
print(search(target))
```

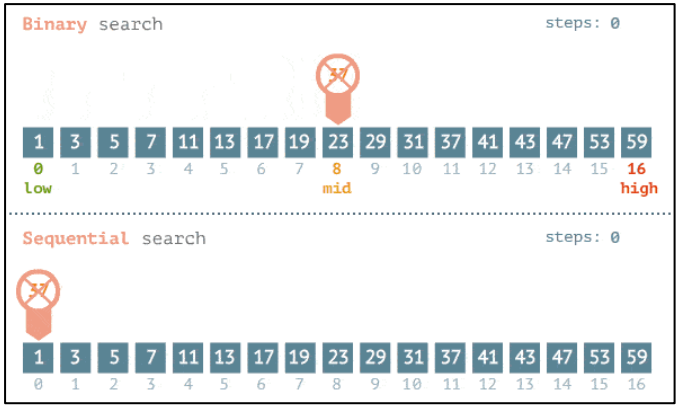
Time complexity: O(n)

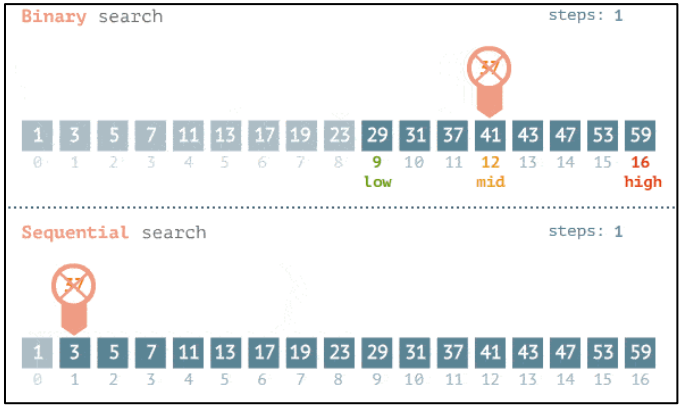
```python
arr = [-1,0,3,5,9,12]
target = 9
def search(self, arr, target):
    left = 0
    right = len(arr)-1
    while left<=right:
        mid = (left+right)//2
        if arr[mid]==target:
            return mid
        elif arr[mid]>target:
            right = mid-1
        else:
            left = mid+1
    return -1
```

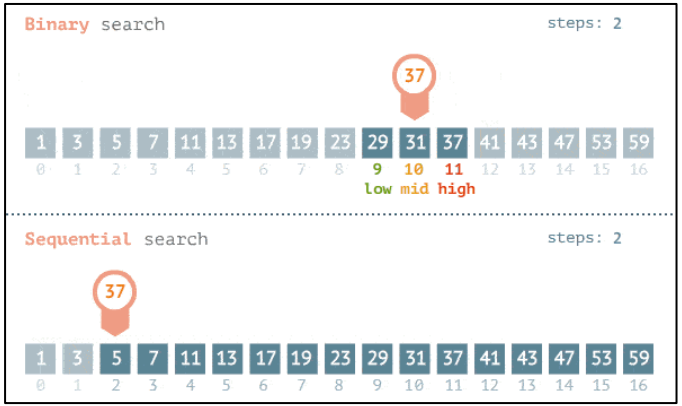
```python
arr = [-1,0,3,5,9,12]
target = 9
def search(arr, target):
    if not target in arr:
        return -1
    else:
        return arr.index(target)
```

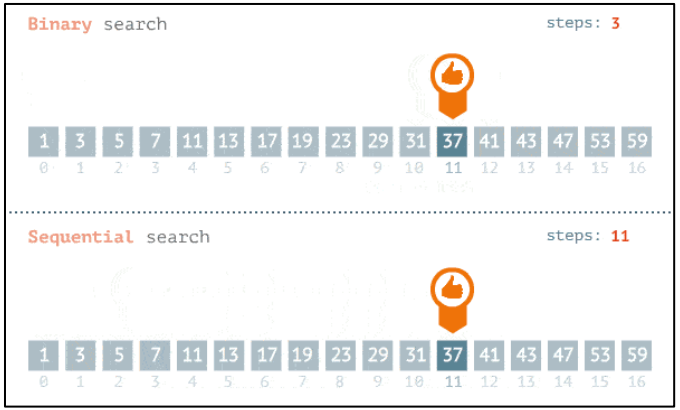
Time complexity: O(logn)

Data structure



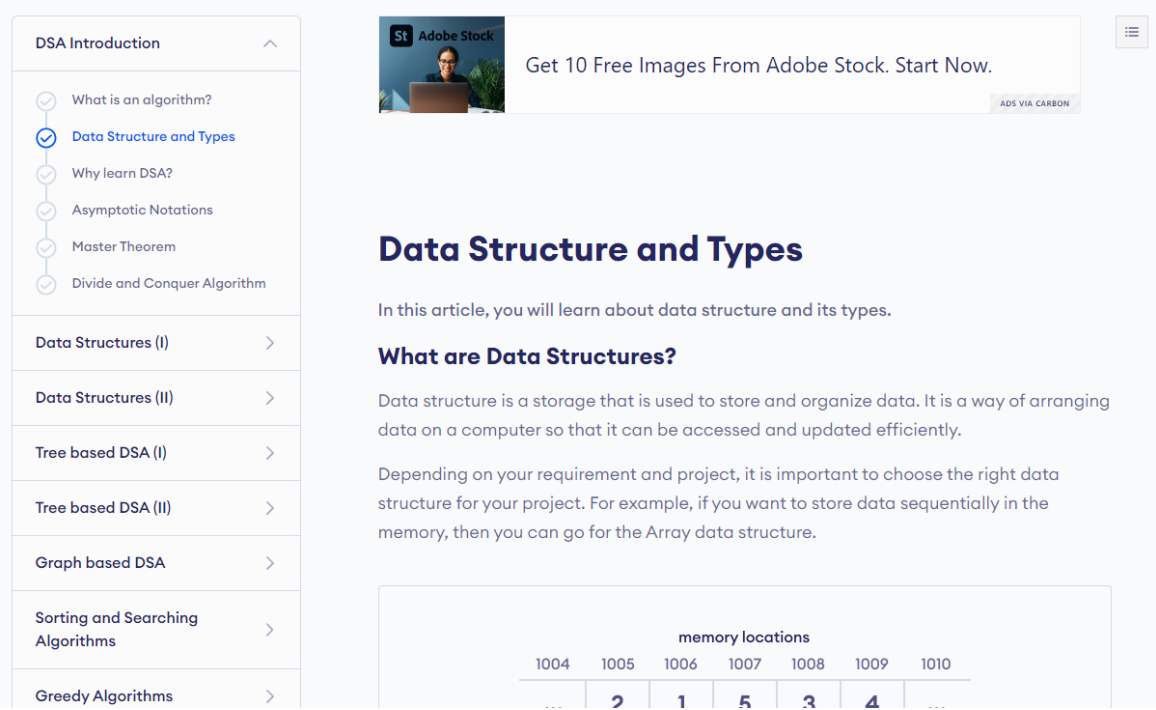






Data structure

https://www.programiz.com/dsa/data-structure-types



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Algorithms and data structures

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- **A process or set of rules**

- Dictionaries
- Linked lists
- Binary search tree
- Arrays, Lists, Sets
- Heap, stack
- Monotonic stack

Core ML/DL concepts

- Matrix multiplication
- Neural network structure (layers)
- Inference
- Backpropagation
- Activation functions
- Error functions
- Regularizations

Tools and frameworks

- Pytorch
- Tensorflow
- Keras

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- Linux

Core ML/DL concepts

- Matrix multiplication
- Neural network structure (layers)
- Inference
- Backpropagation
- Activation functions
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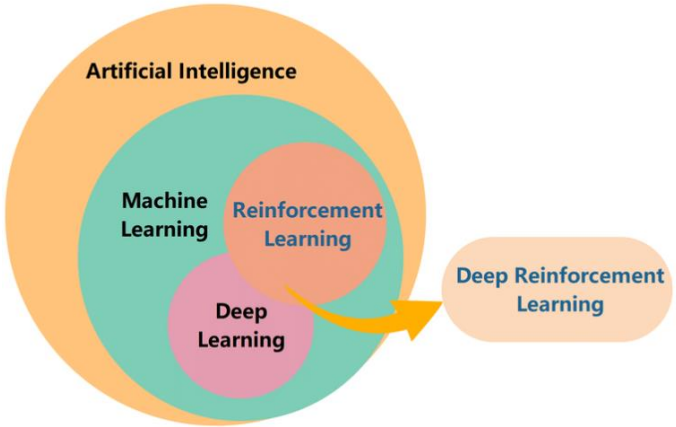
- Regularizations

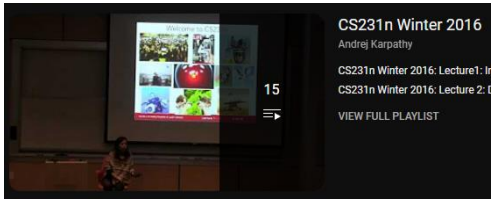
- ML solution types
- DNN types

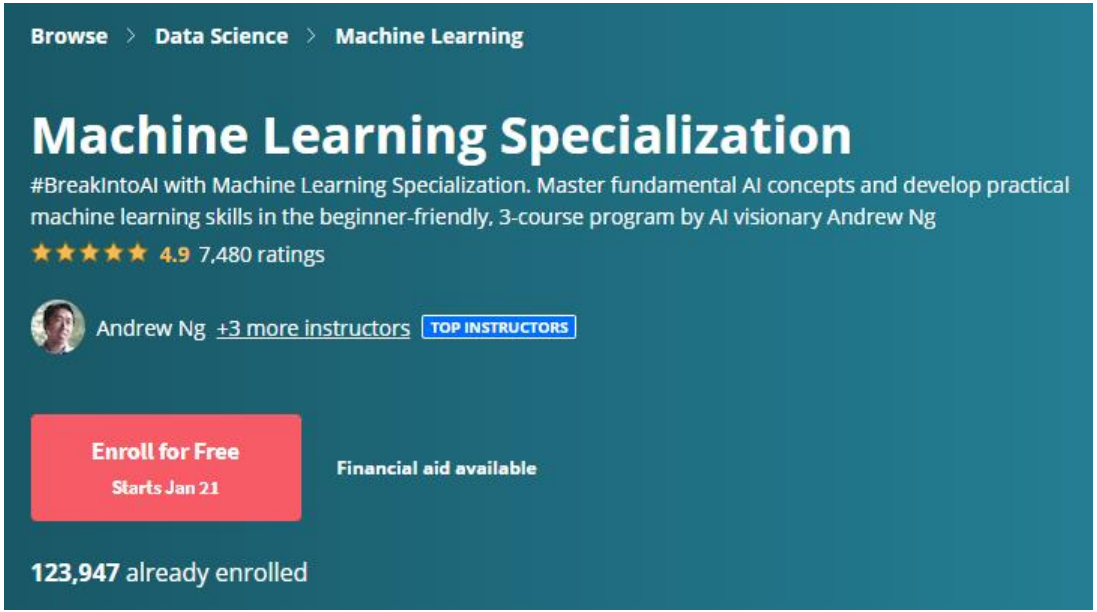


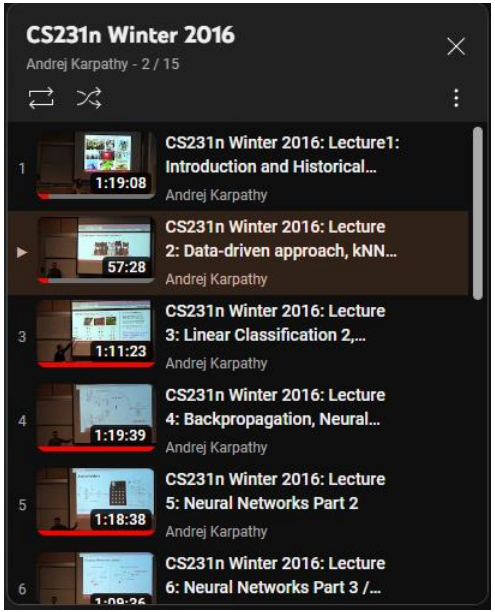
Core ML/DL concepts

Must-learn courses:

- Coursera: Machine learning by Andrew Ng (ML and DL concepts)
- YouTube: cs231n 2016 winter by Andrej Karpathy (theory, impl., types)

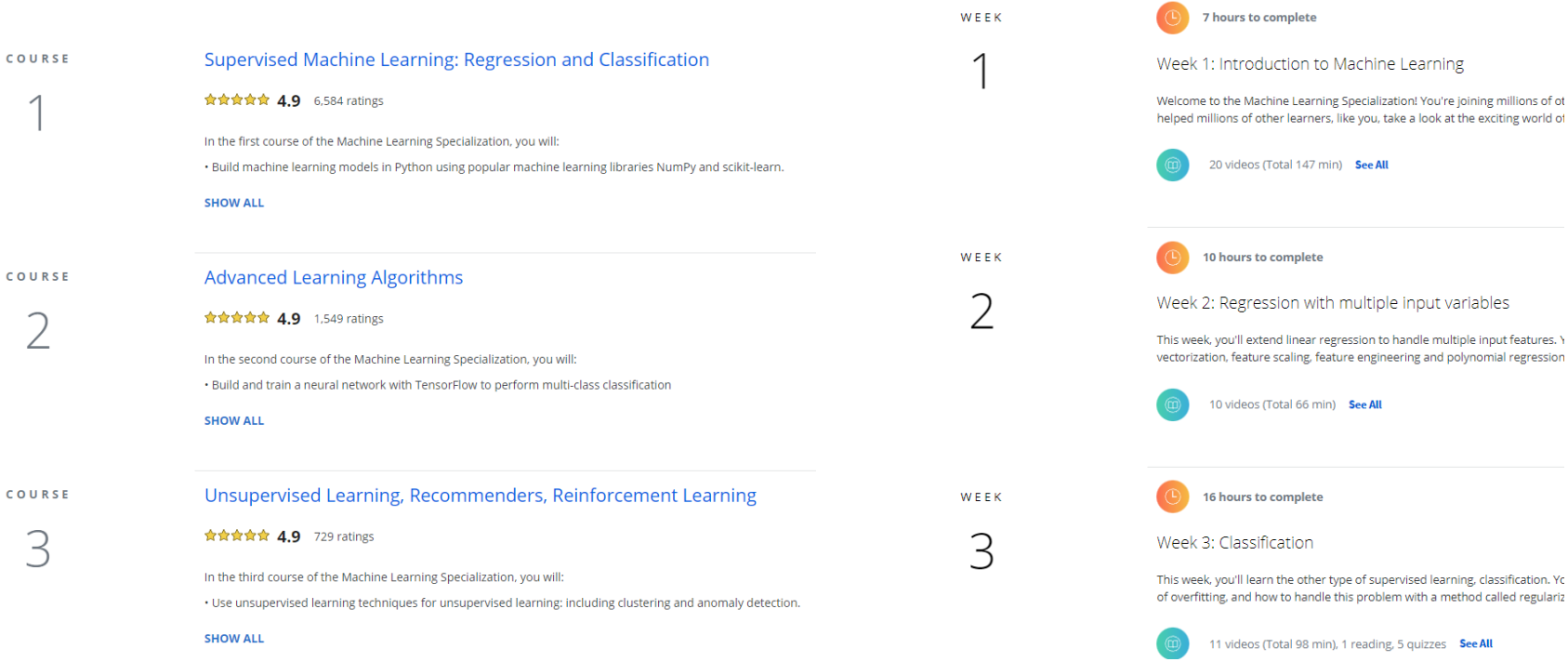






Core ML/DL concepts

- Coursera: Machine learning by Andrew Ng



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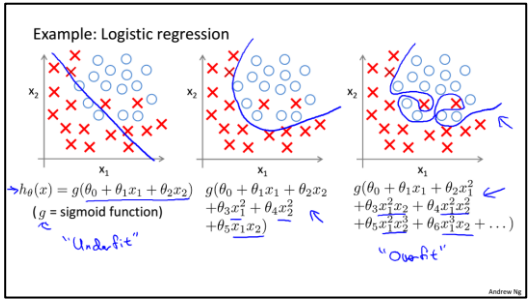
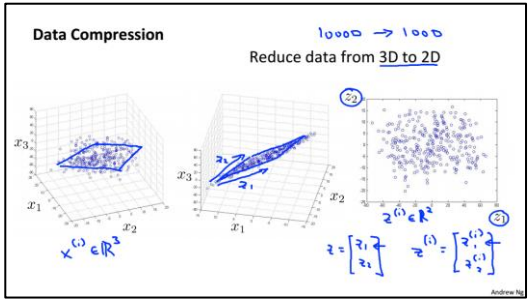
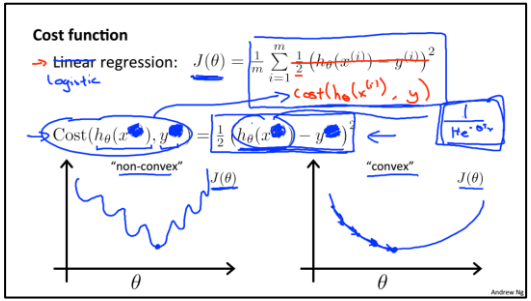
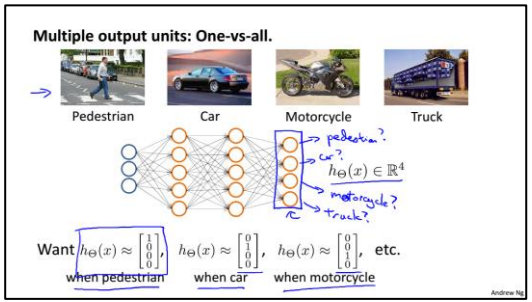
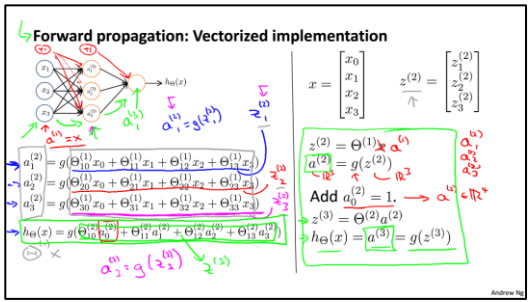
- Coursera: Machine learning by Andrew Ng

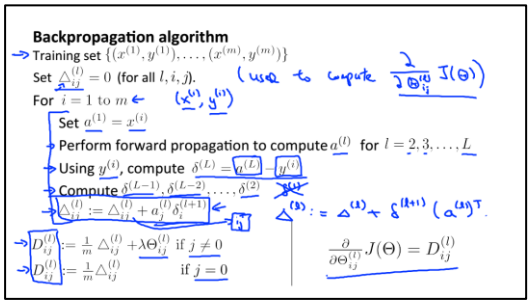






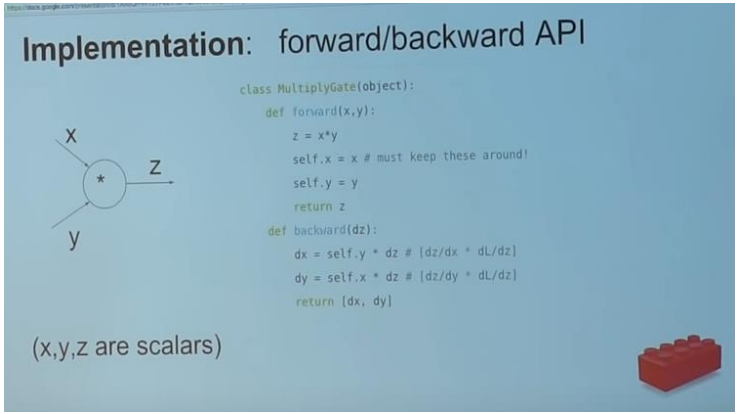


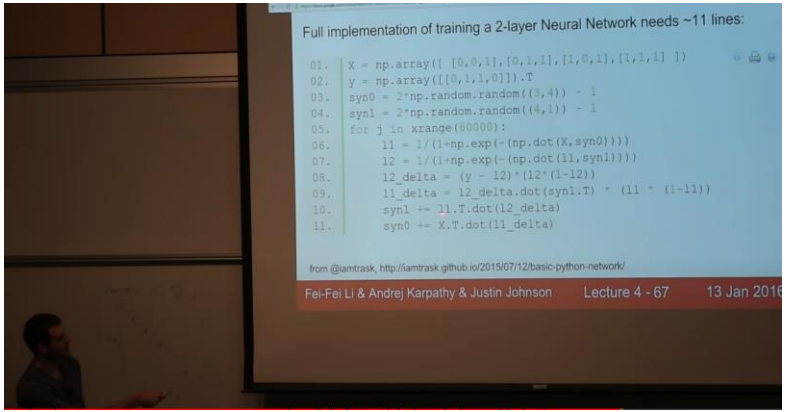


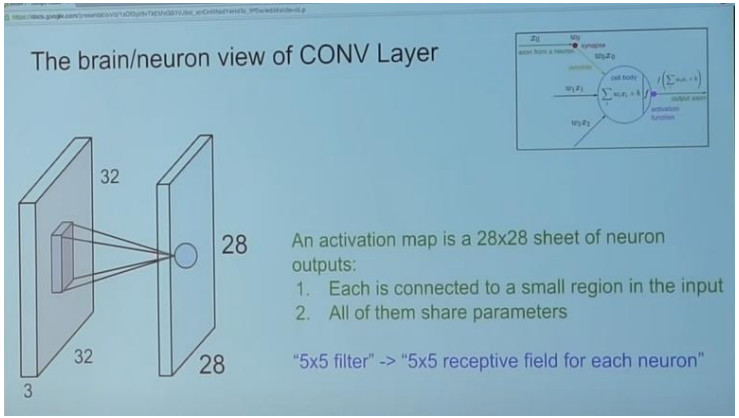


Core ML/DL concepts

- YouTube: cs231n 2016 winter by Andrej Karpathy







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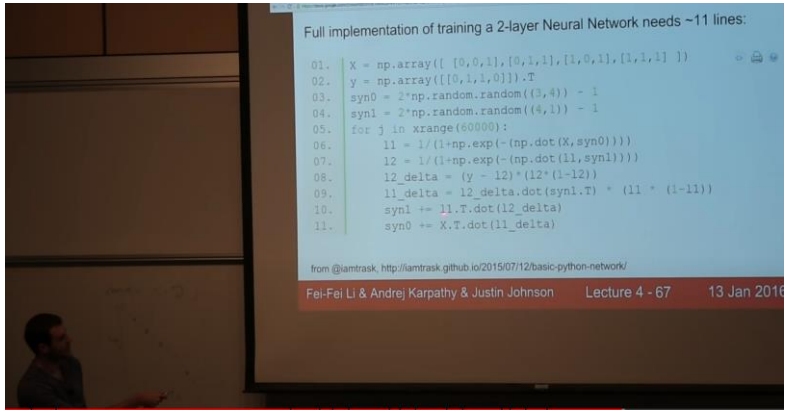


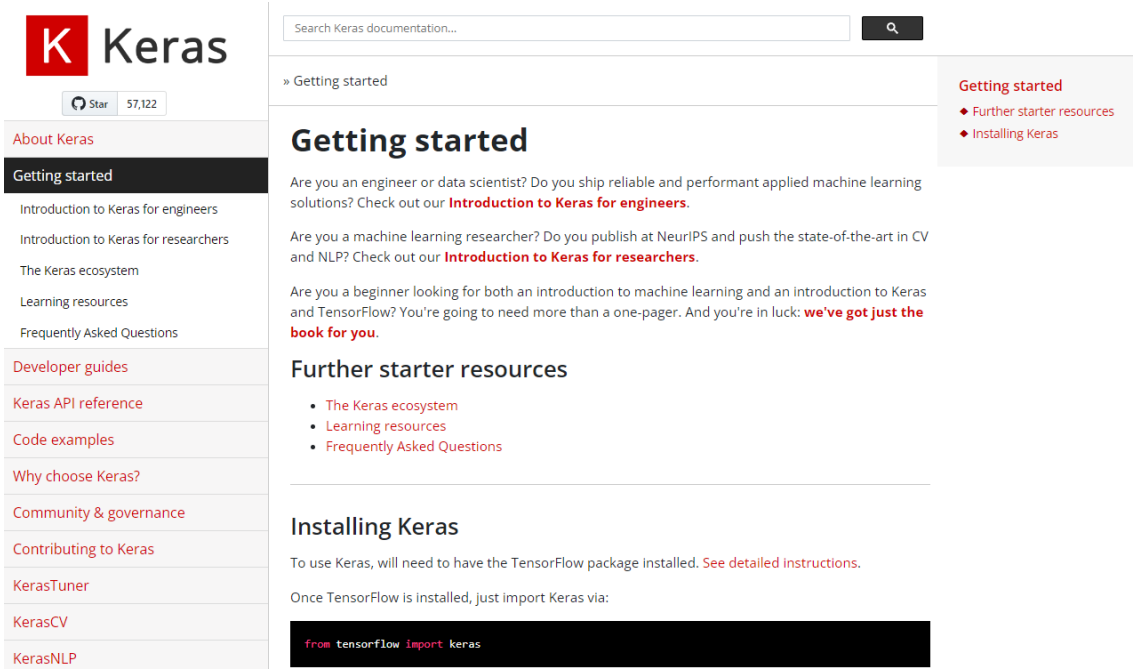

```python
import tensorflow as tf

input_layer = tf.keras.layers.Input(shape=(28,28))
hidden_layer = tf.keras.layers.Dense(units=32, activation='relu')(input_layer)
output_layer = tf.keras.layers.Dense(units=2, activation='softmax')(hidden_layer)

model = tf.keras.Model(inputs=input_layer, outputs=output_layer)
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
model.fit(x_train, y_train, epochs=10, batch_size=4)
```

Tools and frameworks

- Pytorch
- Tensorflow
- Keras

- Pandas
- NumPy
- Matplotlib
- OpenCV
- ROS

- Git/GitLab
- Linux



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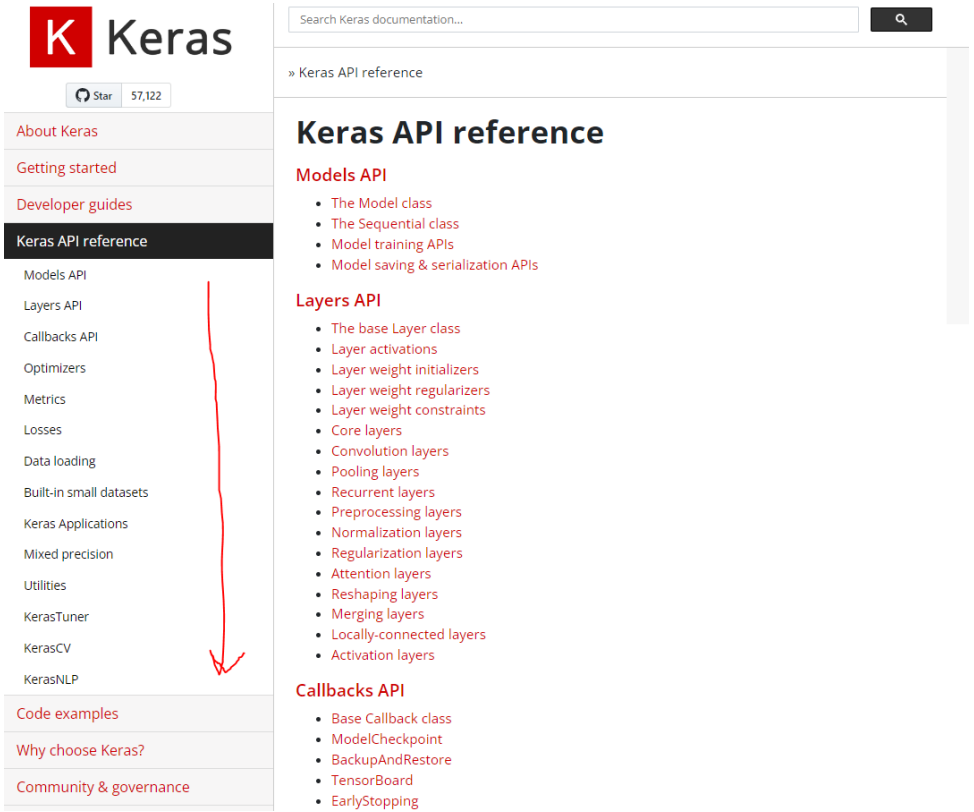

Tools and frameworks

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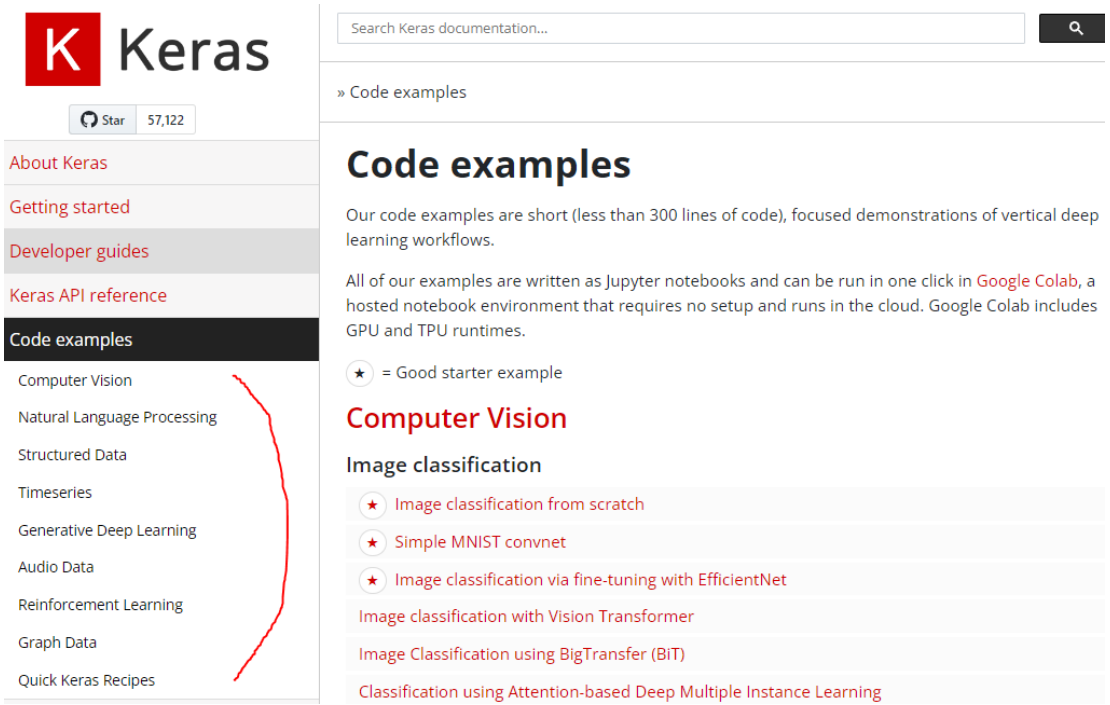

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- Pandas
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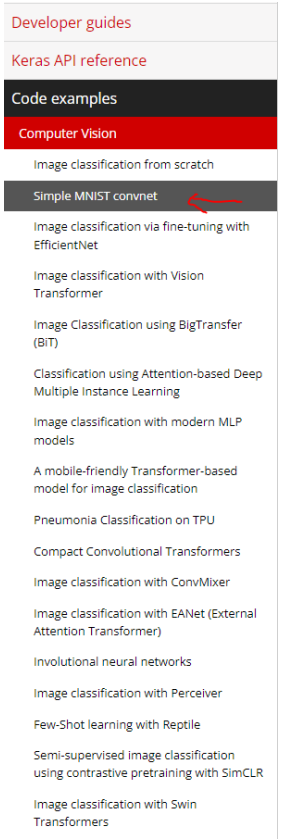


Date created: 2015/06/19
Last modified: 2020/04/21
Description: A simple convnet that achieves ~99% test accuracy on MNIST.

View in Colab · GitHub source

Setup

```
import numpy as np
from tensorflow import keras
from tensorflow.keras import layers
```

Prepare the data

```
# Model / data parameters
num_classes = 10
input_shape = (28, 28, 1)

# Load the data and split it between train and test sets
(x_train, y_train), (x_test, y_test) = keras.datasets.mnist.load_data()

# Scale images to the [0, 1] range
x_train = x_train.astype("float32") / 255
x_test = x_test.astype("float32") / 255
# Make sure images have shape (28, 28, 1)
x_train = np.expand_dims(x_train, -1)
x_test = np.expand_dims(x_test, -1)
print("x_train shape:", x_train.shape)
print(x_train.shape[0], "train samples")
print(x_test.shape[0], "test samples")


# convert class vectors to binary class matrices
y_train = keras.utils.to_categorical(y_train, num_classes)
y_test = keras.utils.to_categorical(y_test, num_classes)
```

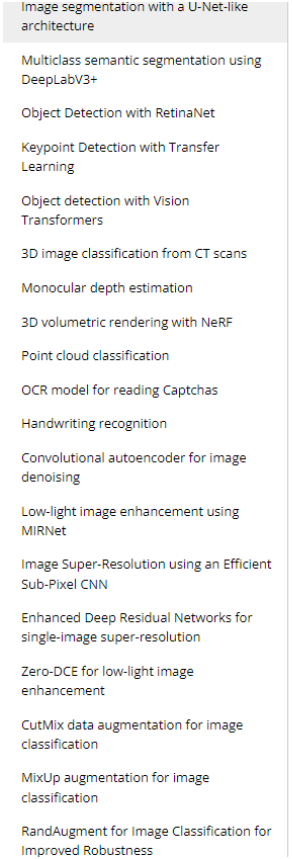
```
x_train shape: (60000, 28, 28, 1)
```

Tools and frameworks

- Pytorch
- Tensorflow
- Keras

- Pandas
- NumPy
- Matplotlib
- OpenCV
- ROS

- Git/GitLab
- Linux



Build the model

```
model = keras.Sequential(
    [
        keras.Input(shape=input_shape),
        layers.Conv2D(32, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Conv2D(64, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Flatten(),
        layers.Dropout(0.5),
        layers.Dense(num_classes, activation="softmax"),
    ]
)

model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 26, 26, 32)        320
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 13, 13, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 11, 11, 64)        18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 5, 5, 64)          0
_________________________________________________________________
flatten (Flatten)            (None, 1600)              0
_________________________________________________________________
dropout (Dropout)            (None, 1600)              0
_________________________________________________________________
dense (Dense)                (None, 10)                16010
=================================================================
Total params: 34,826
Trainable params: 34,826
Non-trainable params: 0
_________________________________________________________________
```

Tools and frameworks

Train the model

```
batch_size = 128
epochs = 15

model.compile(loss="categorical_crossentropy", optimizer="adam", metrics=["accuracy"])

model.fit(x_train, y_train, batch_size=batch_size, epochs=epochs, validation_split=0.1)
```

```
Epoch 1/15
422/422 [==============================] - 13s 29ms/step - loss: 0.7840 - accuracy: 0.7643 - val_
Epoch 2/15
422/422 [==============================] - 13s 31ms/step - loss: 0.1199 - accuracy: 0.9639 - val_
Epoch 3/15
422/422 [==============================] - 14s 33ms/step - loss: 0.0845 - accuracy: 0.9737 - val_
Epoch 4/15
422/422 [==============================] - 14s 33ms/step - loss: 0.0762 - accuracy: 0.9756 - val_
Epoch 5/15
422/422 [==============================] - 15s 35ms/step - loss: 0.0621 - accuracy: 0.9812 - val_
Epoch 6/15
422/422 [==============================] - 17s 40ms/step - loss: 0.0547 - accuracy: 0.9825 - val_
Epoch 7/15
422/422 [==============================] - 17s 41ms/step - loss: 0.0497 - accuracy: 0.9840 - val_
Epoch 8/15
422/422 [==============================] - 16s 39ms/step - loss: 0.0443 - accuracy: 0.9862 - val_
Epoch 9/15
422/422 [==============================] - 17s 39ms/step - loss: 0.0436 - accuracy: 0.9860 - val_
Epoch 10/15
422/422 [==============================] - 16s 38ms/step - loss: 0.0407 - accuracy: 0.9865 - val_
Epoch 11/15
422/422 [==============================] - 16s 37ms/step - loss: 0.0406 - accuracy: 0.9874 - val_
Epoch 12/15
237/422 [==============>.............] - ETA: 7s - loss: 0.0398 - accuracy: 0.9877
```

Available optimizers

- SGD
- RMSprop
- Adam
- AdamW
- Adadelta
- Adagrad
- Adamax
- Adafactor
- Nadam
- Ftrl

Tools and frameworks

- Pytorch
- Tensorflow
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Evaluate the trained model

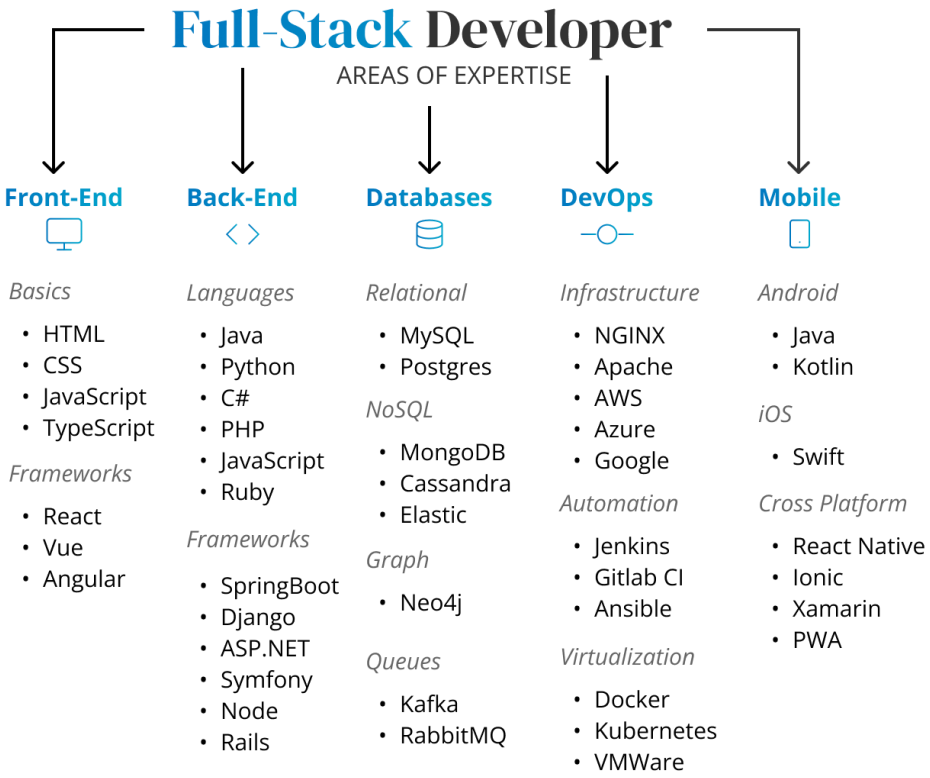
```
score = model.evaluate(x_test, y_test, verbose=0)
print("Test loss:", score[0])
print("Test accuracy:", score[1])
```

```
Test loss: 0.023950600996613503
Test accuracy: 0.9922000169754028
```

Different levels of engineers

- **Junior engineer/developer**: great coder, knows fundamentals, returns what is asked
- **Medior/middle**: junior + good understanding of the software development process, and is able to work independently
- **Senior**: Middle + birds-eye view skills, deeper technical skillset, knows about team roles and processes, system design expert
- **Lead**: Senior + management

Different levels of engineers



Different levels of engineers

Full-Stack Developer

AREAS OF EXPERTISE

Front-End

Basics
- HTML
- CSS
- JavaScript
- TypeScript

Frameworks
- React
- Vue
- Angular

Back-End

Languages
- Java
- Python
- C#
- PHP
- JavaScript
- Ruby

Frameworks
- SpringBoot
- Django
- ASP.NET
- Symfony
- Node
- Rails

Databases

Relational
- MySQL
- Postgres

NoSQL
- MongoDB
- Cassandra
- Elastic

Graph
- Neo4j

Queues
- Kafka
- RabbitMQ

DevOps

Infrastructure
- NGINX
- Apache
- AWS
- Azure
- Google

Automation
- Jenkins
- Gitlab CI
- Ansible

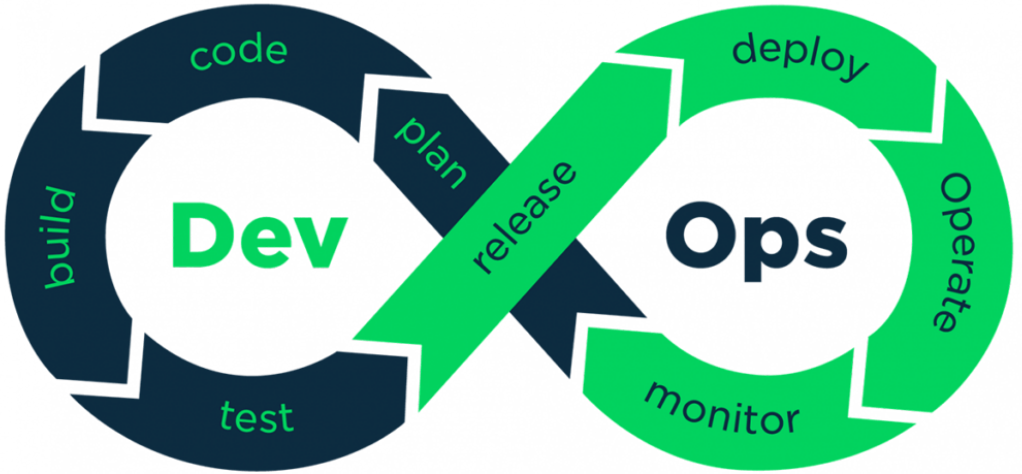
Virtualization
- Docker
- Kubernetes
- VMWare

Mobile

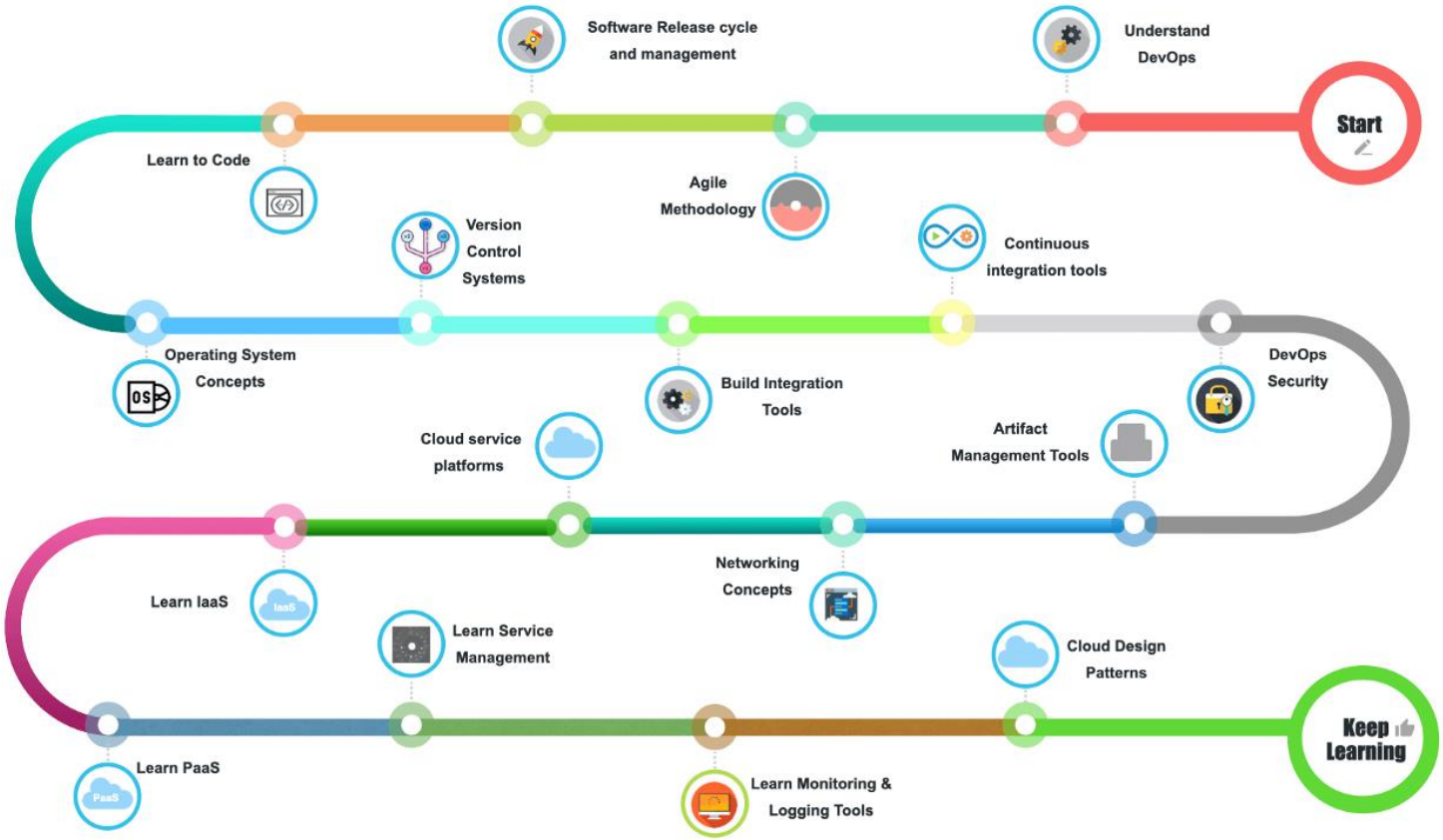
Android
- Java
- Kotlin

iOS
- Swift

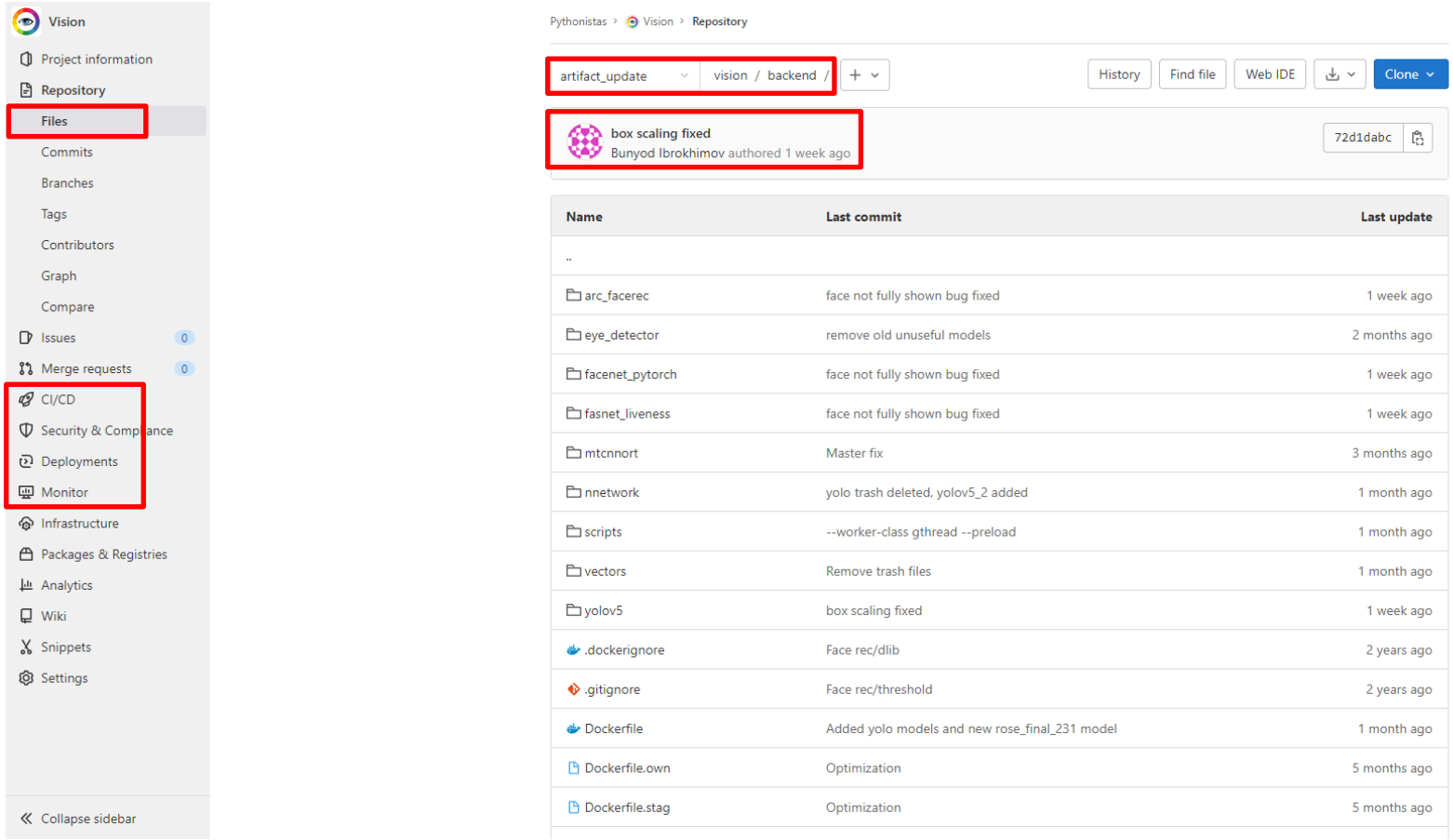
Cross Platform
- React Native
- Ionic
- Xamarin
- PWA



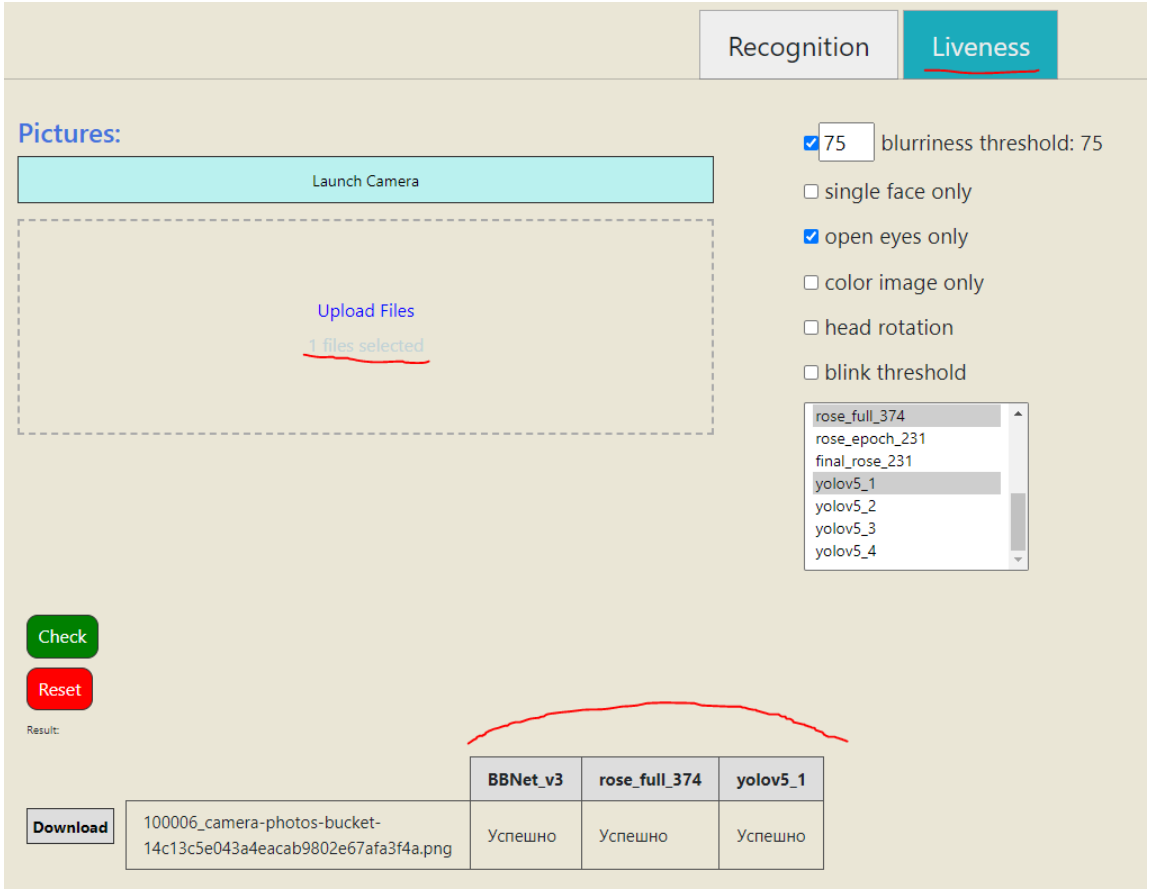
Different levels of engineers



Different levels of engineers



Different levels of engineers



Tips to become a pro

Road to become a senior engineer:

- Write well-design code (clean code: maximize cohesion, minimize coupling)
- Learn dependency injection and abstraction
- Document what you learn
- Always have side projects

Tips to become a pro

- OOP – object-oriented programming
  - Inheritance, abstraction, protocols
- Functional programming
- Optimization (make working codes more efficient, e.g., space, time)
- Modular programming
- SOLID principles
- Test-driven development

Tips to become a pro

Road to become a senior engineer:

- Write well-design code (clean code: maximize cohesion, minimize coupling)
- Learn dependency injection and abstraction
- Document what you learn
- Always have side projects

SOLID principle (Uncle Bob principle)

SOLID

From Wikipedia, the free encyclopedia

> *This article is about the SOLID principles of object-oriented programming. For the fundamental state of matter, see Solid. For other uses, see Solid (disambiguation).*

In software engineering, **SOLID** is a mnemonic acronym for five design principles intended to make object-oriented designs more understandable, flexible, and maintainable. The principles are a subset of many principles promoted by American software engineer and instructor Robert C. Martin,[1][2][3] first introduced in his 2000 paper *Design Principles and Design Patterns* discussing software rot.[2][4]:2–3

SOLID

Principles

Single responsibility
Open–closed
Liskov substitution
Interface segregation
Dependency inversion

V · T · E

The SOLID ideas are

- The **S**ingle-responsibility principle: "There should never be more than one reason for a class to change."[5] In other words, every class should have only one responsibility.[6]
- The **O**pen–closed principle: "Software entities ... should be open for extension, but closed for modification."[7]
- The **L**iskov substitution principle: "Functions that use pointers or references to base classes must be able to use objects of derived classes without knowing it."[8] See also design by contract.[8]
- The **I**nterface segregation principle: "Clients should not be forced to depend upon interfaces that they do not use."[9][4]
- The **D**ependency inversion principle: "Depend upon abstractions, [not] concretions."[10][4]

The SOLID acronym was introduced later, around 2004, by Michael Feathers.[11]

Although the SOLID principles apply to any object-oriented design, they can also form a core philosophy for methodologies such as agile development or adaptive software development.[3]

origin.py > ...

```python
class Order:
    items = []
    quantities = []
    prices = []
    status = 'open'

    def add_item(self, name, quantity, price):
        self.items.append(name)
        self.quantities.append(quantity)
        self.prices.append(price)

    def total_price(self):
        total = 0
        for i in range(len(self.prices)):
            total += self.quantities[i] * self.prices[i]
        return total

    def pay(self, payment_type, security_code):
        if payment_type == 'debit':
            print('Processing debit payment type')
            print(f'Verifying security code: {security_code}')
            self.status = 'paid'
        elif payment_type == 'credit':
            print('Processing credit payment type')
            print(f'Verifying security code: {security_code}')
            self.status = 'paid'
        else:
            raise Exception(f"Unknown payment type: {payment_type}")

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

print("Total price: ", order.total_price())
order.pay('debit', '03214')
```

Total price: 2390
Processing debit payment type
Verifying security code: 03214

```
# The Single-responsibility principle:
# There should never be more than one reason
for a class to change.
# In other words, every class should have
only one responsibility.

# In the previous code, Order class has more
than one responsibility, lets fix that.
```

origin.py > ...

```python
class Order:
    items = []
    quantities = []
    prices = []
    status = 'open'

    def add_item(self, name, quantity, price):
        self.items.append(name)
        self.quantities.append(quantity)
        self.prices.append(price)

    def total_price(self):
        total = 0
        for i in range(len(self.prices)):
            total += self.quantities[i] * self.prices[i]
        return total

    def pay(self, payment_type, security_code):
        if payment_type == 'debit':
            print('Processing debit payment type')
            print(f'Verifying security code: {security_code}')
            self.status = 'paid'
        elif payment_type == 'credit':
            print('Processing credit payment type')
            print(f'Verifying security code: {security_code}')
            self.status = 'paid'
        else:
            raise Exception(f"Unknown payment type: {payment_type}")

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

print("Total price: ", order.total_price())
order.pay('debit', '03214')
```

```python
class Order:
    items = []
    quantities = []
    prices = []
    status = 'open'

    def add_item(self, name, quantity, price):
        self.items.append(name)
        self.quantities.append(quantity)
        self.prices.append(price)

    def total_price(self):
        total = 0
        for i in range(len(self.prices)):
            total += self.quantities[i] * self.prices[i]
        return total

class PaymentProcessor:
    def debit_pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

    def credit_pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'


order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaymentProcessor()
print("Total price: ", order.total_price())
payment.credit_pay(order, '03214')
```

```python
class Order:
    items = []
    quantities = []
    prices = []
    status = 'open'

    def add_item(self, name, quantity, price):
        self.items.append(name)
        self.quantities.append(quantity)
        self.prices.append(price)

    def total_price(self):
        total = 0
        for i in range(len(self.prices)):
            total += self.quantities[i] * self.prices[i]
        return total

class PaymentProcessor:
    def debit_pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

    def credit_pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'


order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaymentProcessor()
print("Total price: ", order.total_price())
payment.credit_pay(order, '03214')

```

```
# The Open-closed principle
# Software entities ... should be open for extension
but closed for modification.

# In the previous code we cannot add new payment
methods without changing the class. Let's fix
that...
```

```python
class Order:
    items = []
    quantities = []
    prices = []
    status = 'open'

    def add_item(self, name, quantity, price):
        self.items.append(name)
        self.quantities.append(quantity)
        self.prices.append(price)

    def total_price(self):
        total = 0
        for i in range(len(self.prices)):
            total += self.quantities[i] * self.prices[i]
        return total

class PaymentProcessor:
    def debit_pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

    def credit_pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'


order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaymentProcessor()
print("Total price: ", order.total_price())
payment.credit_pay(order, '03214')

```

```python
from abc import ABC, abstractmethod
```

```python
class PaymentProcessor(ABC):
    @abstractmethod
    def pay(self, order, security_code):
        pass

class DebitPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class CreditPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class PaypalPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing paypal payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaypalPaymentProcessor()
print("Total price:", order.total_price())
payment.pay(order, '03214')
```

```python
from abc import ABC, abstractmethod

class PaymentProcessor(ABC):
    @abstractmethod
    def pay(self, order, security_code):
        pass

class DebitPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class CreditPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class PaypalPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing paypal payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaypalPaymentProcessor()
print("Total price:", order.total_price())
payment.pay(order, '03214')
```

```
# The Liskov substitution principle:
# Functions that use pointers or references to base
classes must be able to use objects of derived
classes without knowing it.

# In the previous code, if we want to change
security_code to email_address for paypal payment
method, we are abusing PaymentProcessor class for
something it is not supposed to do. And this
violates Liskov substitution principle. Let's fix
that...
```

```python
from abc import ABC, abstractmethod
```

```python
class PaymentProcessor(ABC):
    @abstractmethod
    def pay(self, order, security_code):
        pass

class DebitPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing debit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class CreditPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing credit payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

class PaypalPaymentProcessor:
    def pay(self, order, security_code):
        print('Processing paypal payment type')
        print(f'Verifying security code: {security_code}')
        order.status = 'paid'

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = PaypalPaymentProcessor()
print("Total price:", order.total_price())
payment.pay(order, '03214')
```

```python
class DebitPaymentProcessor(PaymentProcessor):
    def __init__(self, security_code):
        self.security_code = security_code

    def pay(self, order):
        print('Processing debit payment type')
        print(f'Verifying security code: {self.security_code}')
        order.status = 'paid'

class CreditPaymentProcessor(PaymentProcessor):
    def __init__(self, security_code):
        self.security_code = security_code

    def pay(self, order):
        print('Processing credit payment type')
        print(f'Verifying security code: {self.security_code}')
        order.status = 'paid'

class PaypalPaymentProcessor(PaymentProcessor):
    def __init__(self, email_address):
        self.email_address = email_address

    def pay(self, order):
        print('Processing paypal payment type')
        print(f'Verifying email address: {self.email_address}')
        order.status = 'paid'

order = Order()
order.add_item("iPhone 12 Pro", 1, 1290)
order.add_item("Macbook Air", 1, 1100)

payment = CreditPaymentProcessor("04132")
print("Total price:", order.total_price())
payment.pay(order)
```

Homework: finish I and D

```
# The Interface segregation principle:
# Clients should not be forced to depend
upon interfaces that they do not use.

# In the previous code, we are abusing
credit card method to use sms
authenticate,
# And this violates Interface segregation
principle. Let's fix that...
```

```
# The Dependency inversion principle:
# Depend upon abstractions, [not] concretions.

# In the previous code, if we want to add new
authentication method, we have to change SMSAuth
class because it has dependency
# Instead we can create new authorizer class so
that we can easily add new auth types in future.
Let's fix that...
```

Agenda

01

What is software engineering?

02

Where to start:
A Roadmap

03

Different levels of software engineer

04

Tips to become a pro

Thank You

Q & A