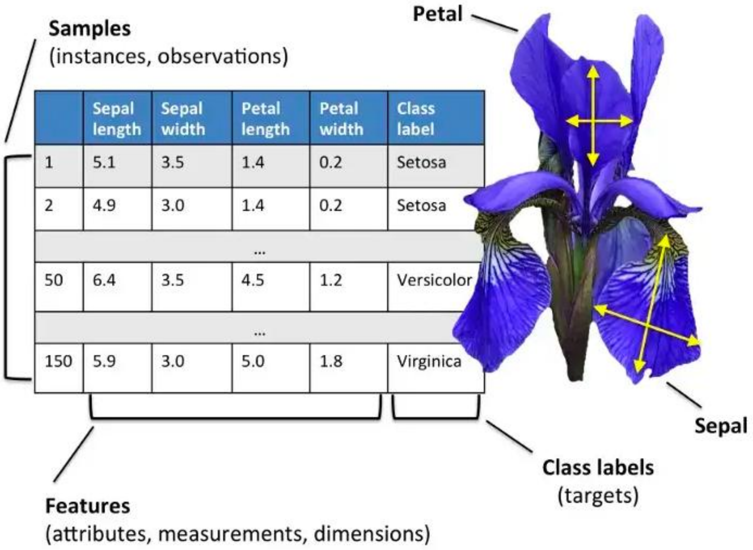
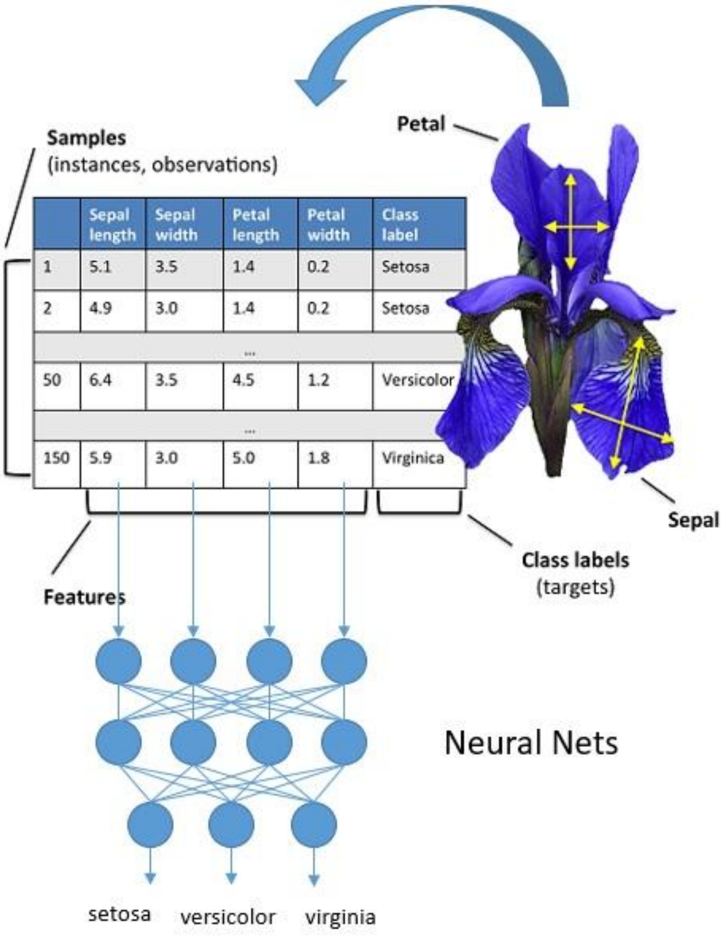
Nama Dosen : Teguh Iman Hermanto, M.Kom
Mata Kuliah : Machine Learning 2
Pembahasan : Implementasi ANN KOTLIN
Pokok Pemb : Implementasi ANN dengan Tensorflow Lite dan Kotlin (IRIS)

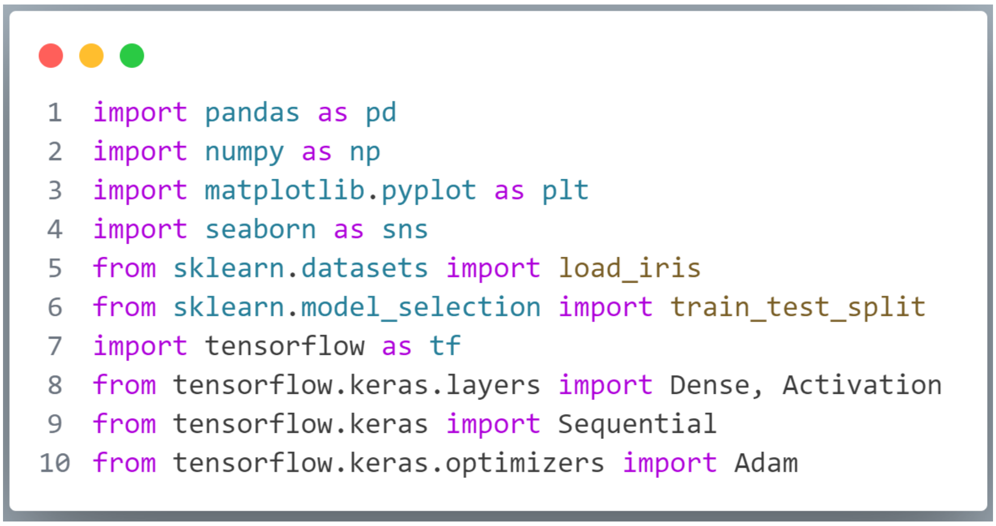

Samples
(instances, observations)
Petal
Sepal
Class labels
(targets)
Features
(attributes, measurements, dimensions)

	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
			…		
50	6.4	3.5	4.5	1.2	Versicolor
			…		
150	5.9	3.0	5.0	1.8	Virginica



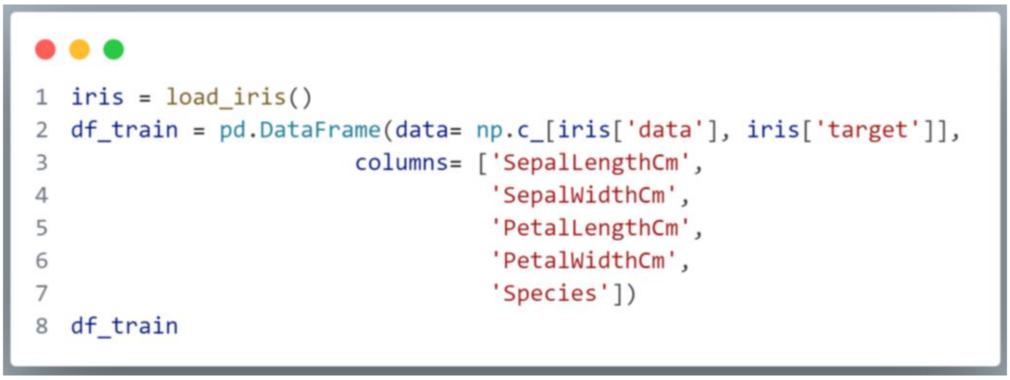
	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
			…		
50	6.4	3.5	4.5	1.2	Versicolor
			…		
150	5.9	3.0	5.0	1.8	Virginica

Import Library yang dibutuhkan



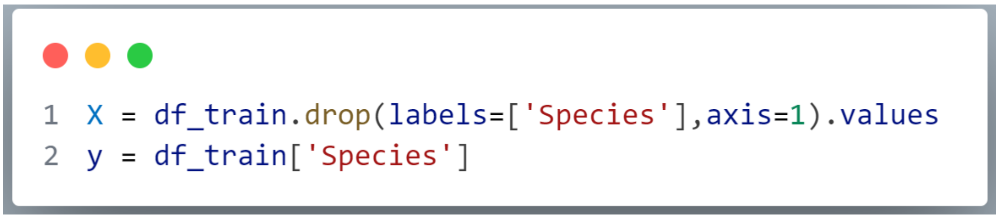
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
import tensorflow as tf
from tensorflow.keras.layers import Dense, Activation
from tensorflow.keras import Sequential
from tensorflow.keras.optimizers import Adam
```

Membuat Dataframe



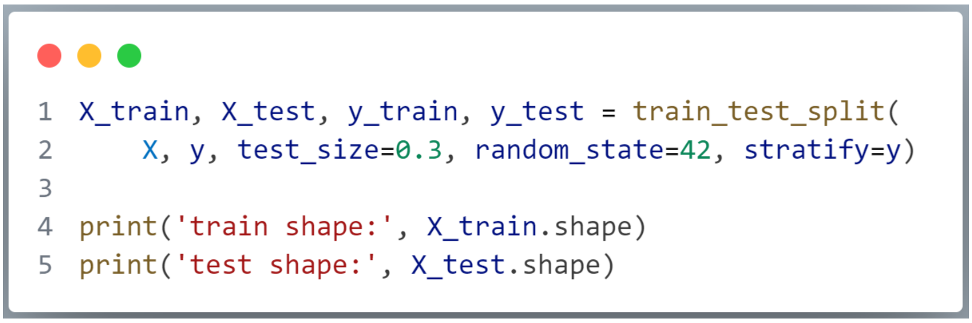
```
iris = load_iris()
df_train = pd.DataFrame(data= np.c_[iris['data'], iris['target']],
                     columns= ['SepalLengthCm',
                               'SepalWidthCm',
                               'PetalLengthCm',
                               'PetalWidthCm',
                               'Species'])
df_train
```

Menentukan Fitur dan Label



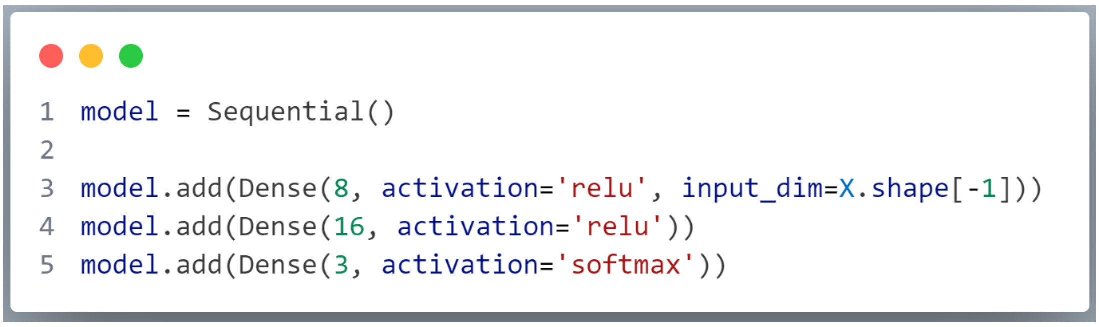
```
X = df_train.drop(labels=['Species'],axis=1).values
y = df_train['Species']
```

Split data training dan testing



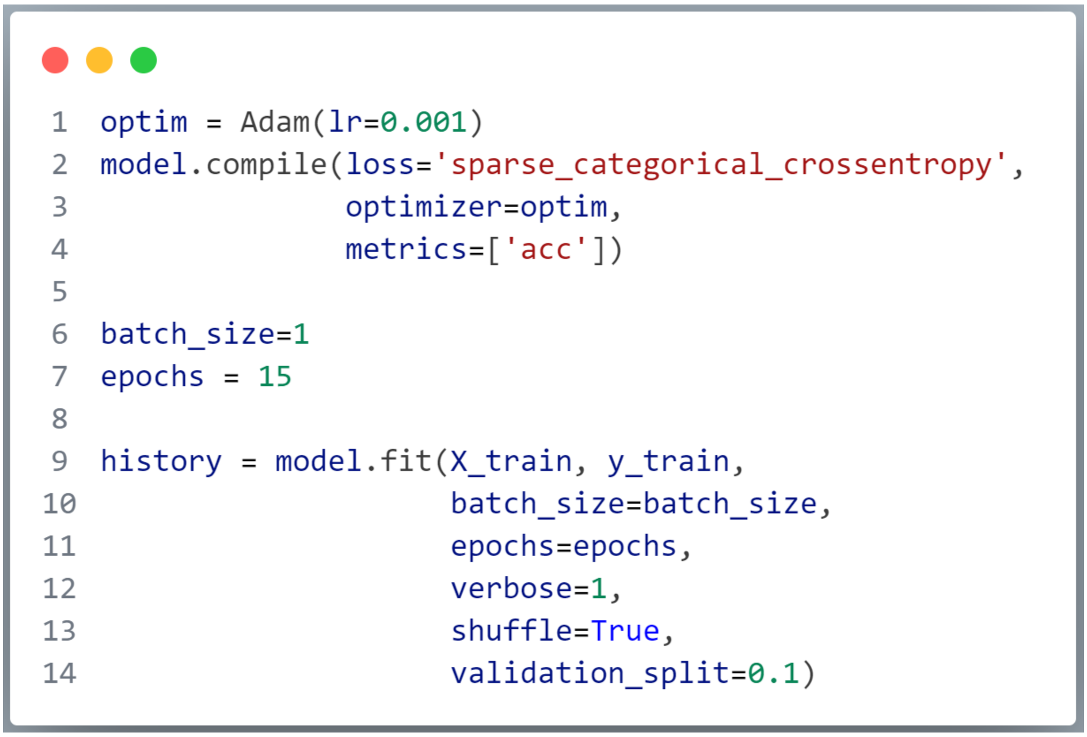
```
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.3, random_state=42, stratify=y)

print('train shape:', X_train.shape)
print('test shape:', X_test.shape)
```

Membuat Model



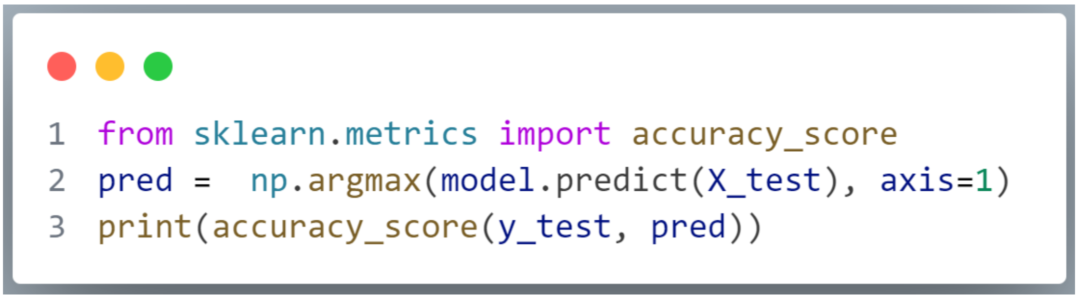
```python
model = Sequential()

model.add(Dense(8, activation='relu', input_dim=X.shape[-1]))
model.add(Dense(16, activation='relu'))
model.add(Dense(3, activation='softmax'))
```

Menjalankan Model



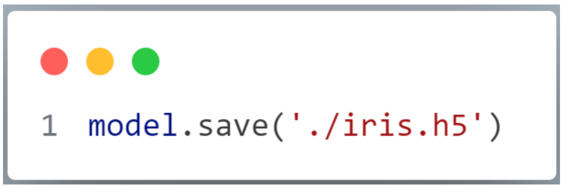
```python
optim = Adam(lr=0.001)
model.compile(loss='sparse_categorical_crossentropy',
              optimizer=optim,
              metrics=['acc'])

batch_size=1
epochs = 15

history = model.fit(X_train, y_train,
                    batch_size=batch_size,
                    epochs=epochs,
                    verbose=1,
                    shuffle=True,
                    validation_split=0.1)
```

Cek Akurasi Model

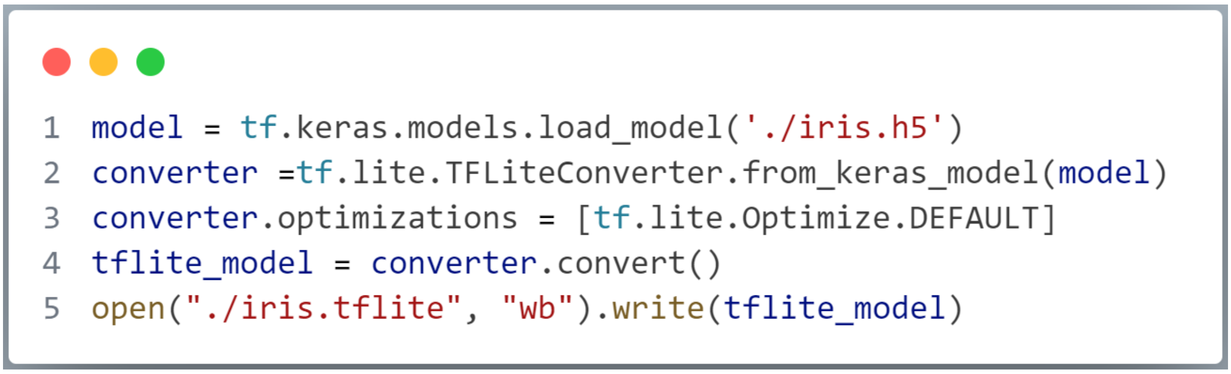


```python
from sklearn.metrics import accuracy_score
pred =  np.argmax(model.predict(X_test), axis=1)
print(accuracy_score(y_test, pred))
```

Menyimpan Model

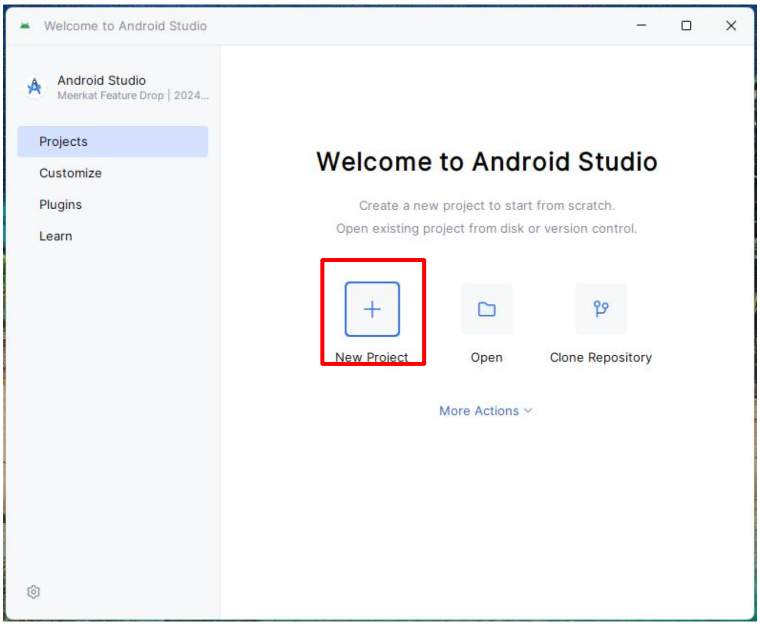


```python
model.save('./iris.h5')
```



```python
model = tf.keras.models.load_model('./iris.h5')
converter =tf.lite.TFLiteConverter.from_keras_model(model)
converter.optimizations = [tf.lite.Optimize.DEFAULT]
tflite_model = converter.convert()
open("./iris.tflite", "wb").write(tflite_model)
```

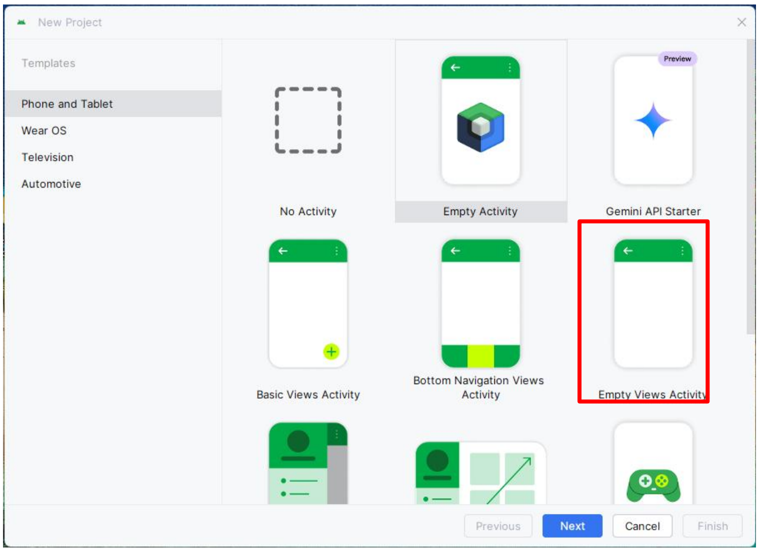
Membuat Project Baru di Android Studio

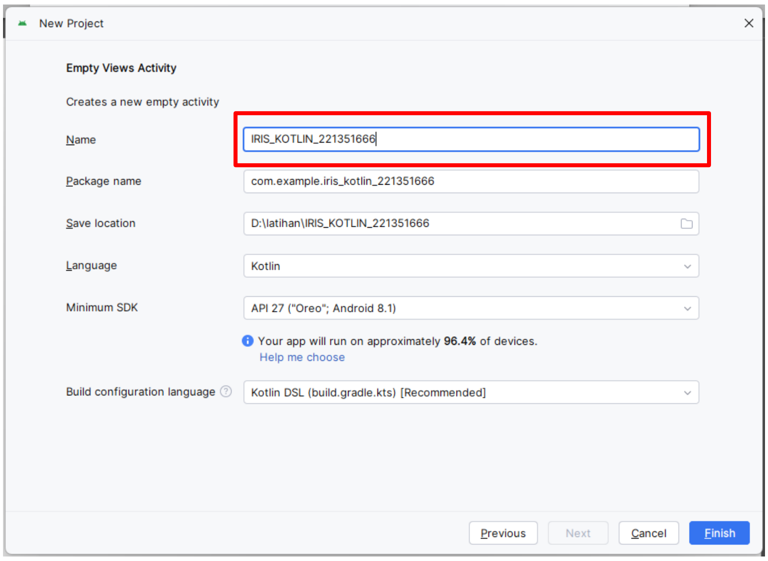


Welcome to Android Studio

Create a new project to start from scratch.

Open existing project from disk or version control.





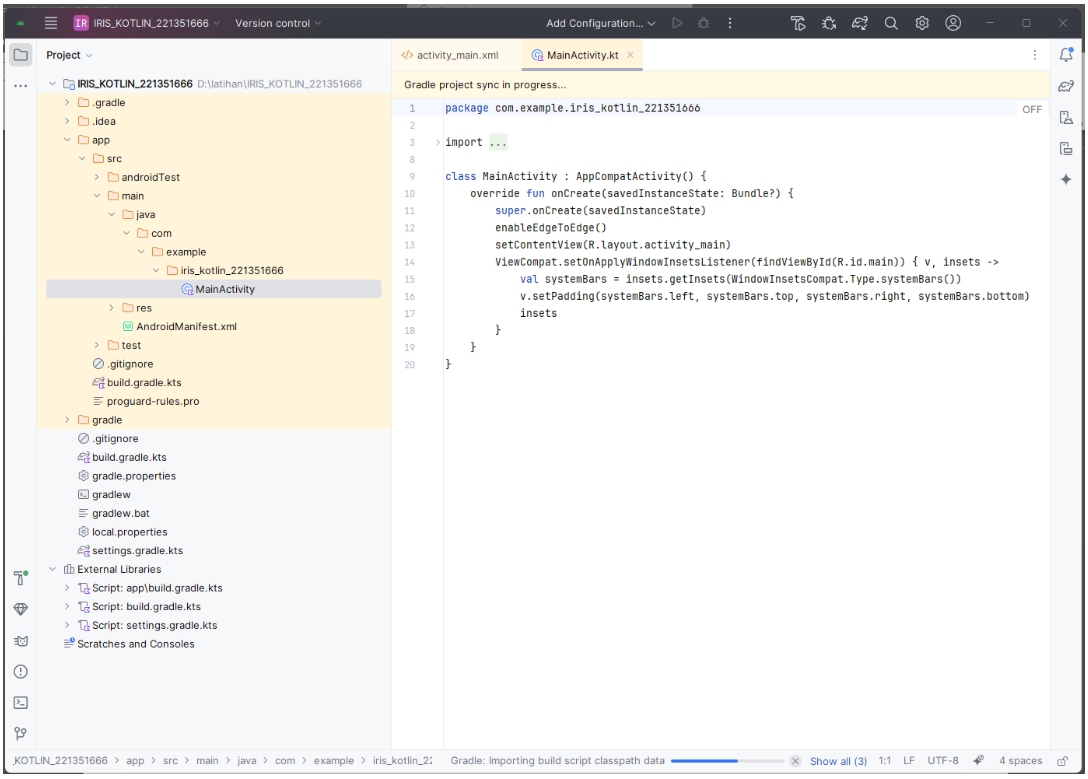
Empty Views Activity

Creates a new empty activity

Name	IRIS_KOTLIN_221351666
Package name	com.example.iris_kotlin_221351666
Save location	D:\latihan\IRIS_KOTLIN_221351666
Language	Kotlin
Minimum SDK	API 27 ("Oreo"; Android 8.1)
Build configuration language	Kotlin DSL (build.gradle.kts) [Recommended]

Your app will run on approximately **96.4%** of devices.
Help me choose

Tunggu Proses Build Gradle sampai selesai

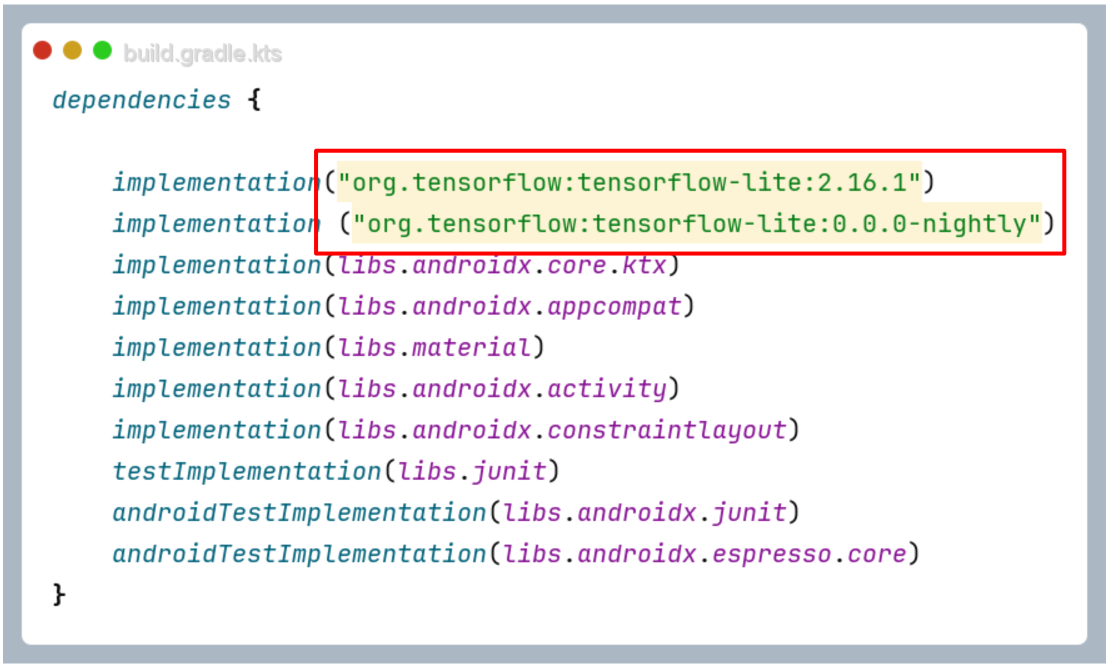


Gradle project sync in progress...

```kotlin
package com.example.iris_kotlin_221351666

import ...

class MainActivity : AppCompatActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContentView(R.layout.activity_main)
        ViewCompat.setOnApplyWindowInsetsListener(findViewById(R.id.main)) { v, insets ->
            val systemBars = insets.getInsets(WindowInsetsCompat.Type.systemBars())
            v.setPadding(systemBars.left, systemBars.top, systemBars.right, systemBars.bottom)
            insets
        }
    }
}
```

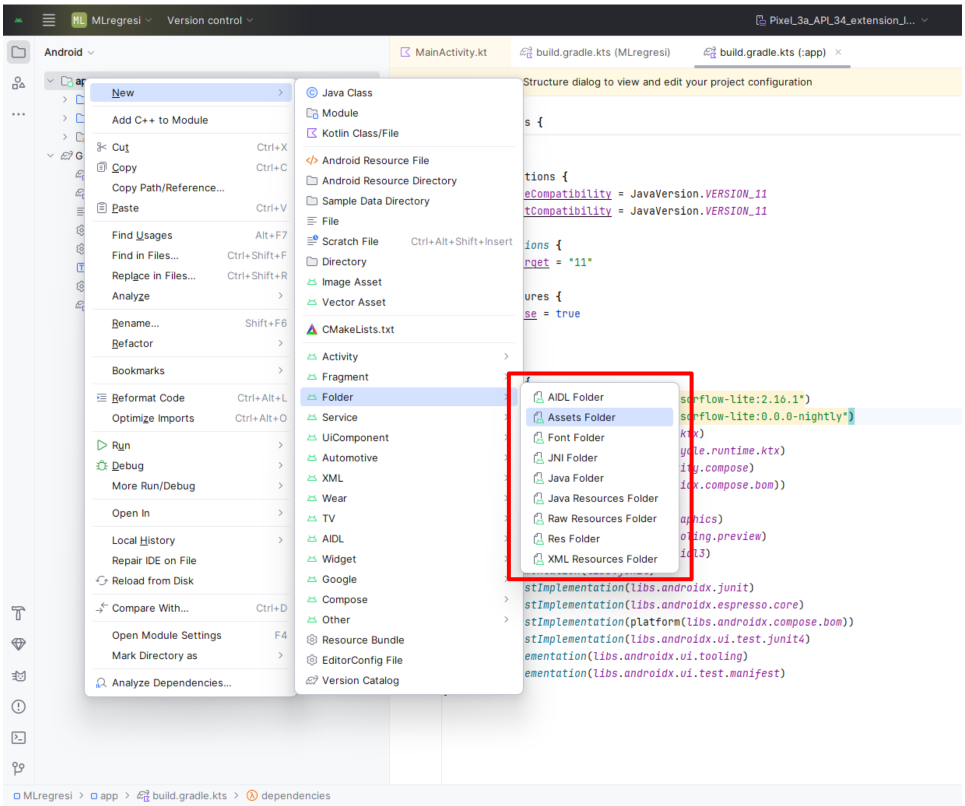
Gradle: Importing build script classpath data

Menambahkan tensorflow package pada file build.gradle



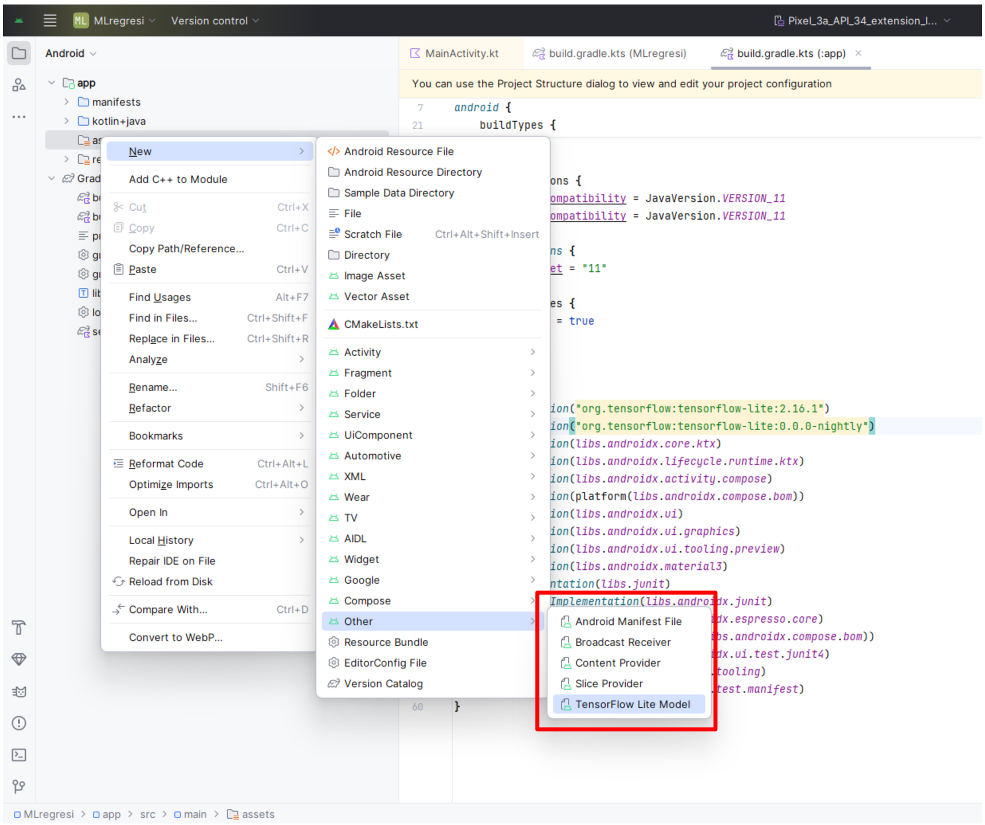
```kotlin
dependencies {

    implementation("org.tensorflow:tensorflow-lite:2.16.1")
    implementation ("org.tensorflow:tensorflow-lite:0.0.0-nightly")
    implementation(libs.androidx.core.ktx)
    implementation(libs.androidx.appcompat)
    implementation(libs.material)
    implementation(libs.androidx.activity)
    implementation(libs.androidx.constraintlayout)
    testImplementation(libs.junit)
    androidTestImplementation(libs.androidx.junit)
    androidTestImplementation(libs.androidx.espresso.core)
}
```

Menambahkan folder assets untuk menyimpan model



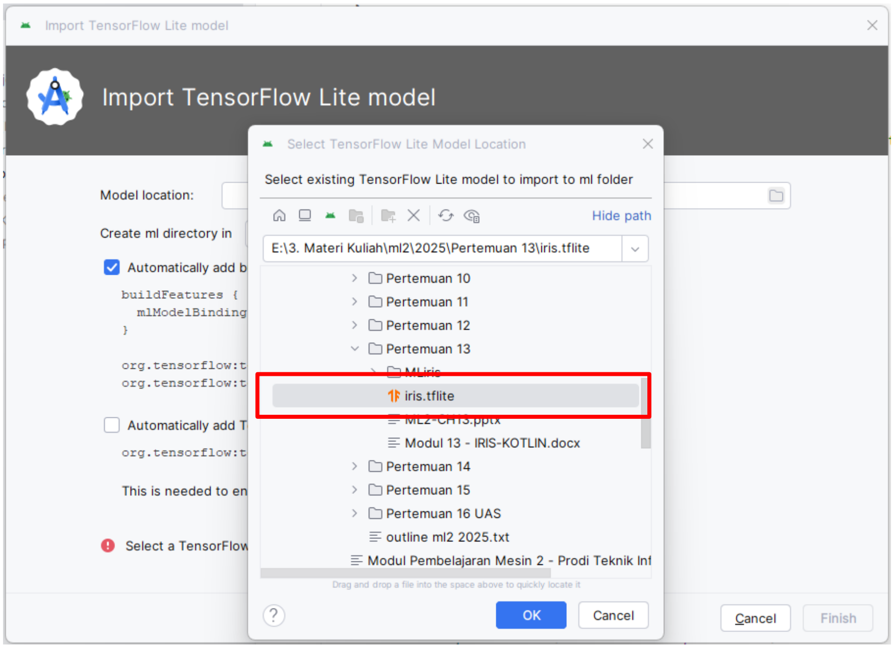
Structure dialog to view and edit your project configuration

```
s {
tions {
eCompatibility = JavaVersion.VERSION_11
tCompatibility = JavaVersion.VERSION_11
ions {
rget = "11"
ures {
se = true
sorflow-lite:2.16.1")
sorflow-lite:0.0.0-nightly")
ktx)
ycle.runtime.ktx)
ity.compose)
idx.compose.bom))
aphics)
oling.preview)
ial3)
stImplementation(libs.androidx.junit)
stImplementation(libs.androidx.espresso.core)
stImplementation(platform(libs.androidx.compose.bom))
stImplementation(libs.androidx.ui.test.junit4)
ementation(libs.androidx.ui.tooling)
ementation(libs.androidx.ui.test.manifest)
```



You can use the Project Structure dialog to view and edit your project configuration

```
android {
    buildTypes {
ons {
ompatibility = JavaVersion.VERSION_11
ompatibility = JavaVersion.VERSION_11
ns {
et = "11"
es {
 = true
ion("org.tensorflow:tensorflow-lite:2.16.1")
ion("org.tensorflow:tensorflow-lite:0.0.0-nightly")
ion(libs.androidx.core.ktx)
ion(libs.androidx.lifecycle.runtime.ktx)
ion(libs.androidx.activity.compose)
ion(platform(libs.androidx.compose.bom))
ion(libs.androidx.ui)
ion(libs.androidx.ui.graphics)
ion(libs.androidx.ui.tooling.preview)
ion(libs.androidx.material3)
ntation(libs.junit)
Implementation(libs.androidx.junit)
dx.espresso.core)
bs.androidx.compose.bom))
dx.ui.test.junit4)
tooling)
test.manifest)
}
```



Import TensorFlow Lite model

Model location:

Create ml directory in

☑ Automatically add b

```
buildFeatures {
  mlModelBinding
}

org.tensorflow:t
org.tensorflow:t
```

□ Automatically add T

```
org.tensorflow:t
```

This is needed to en

Select a TensorFlow

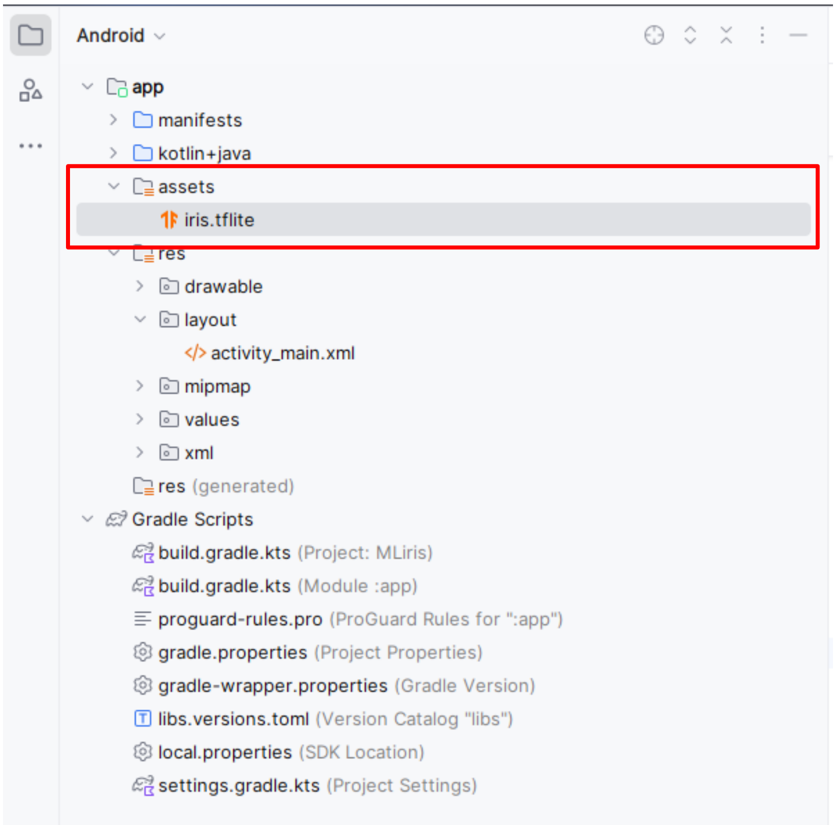
Select TensorFlow Lite Model Location

Select existing TensorFlow Lite model to import to ml folder

E:\3. Materi Kuliah\ml2\2025\Pertemuan 13\iris.tflite

```
Pertemuan 10
Pertemuan 11
Pertemuan 12
Pertemuan 13
  MLiris
  iris.tflite
  ML2-CH13.pptx
  Modul 13 - IRIS-KOTLIN.docx
Pertemuan 14
Pertemuan 15
Pertemuan 16 UAS
outline ml2 2025.txt
Modul Pembelajaran Mesin 2 - Prodi Teknik Inf
```

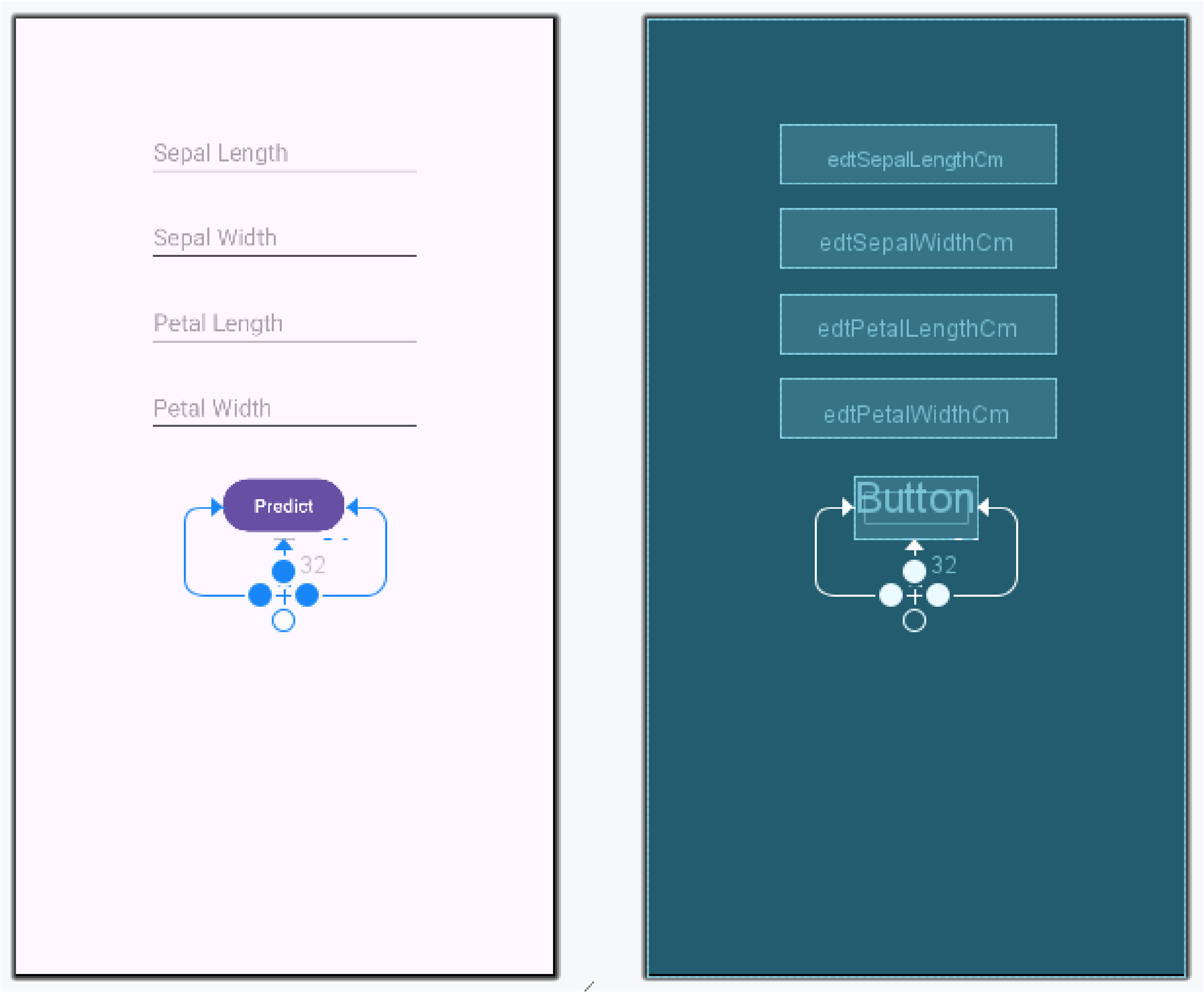
Drag and drop a file into the space above to quickly locate it

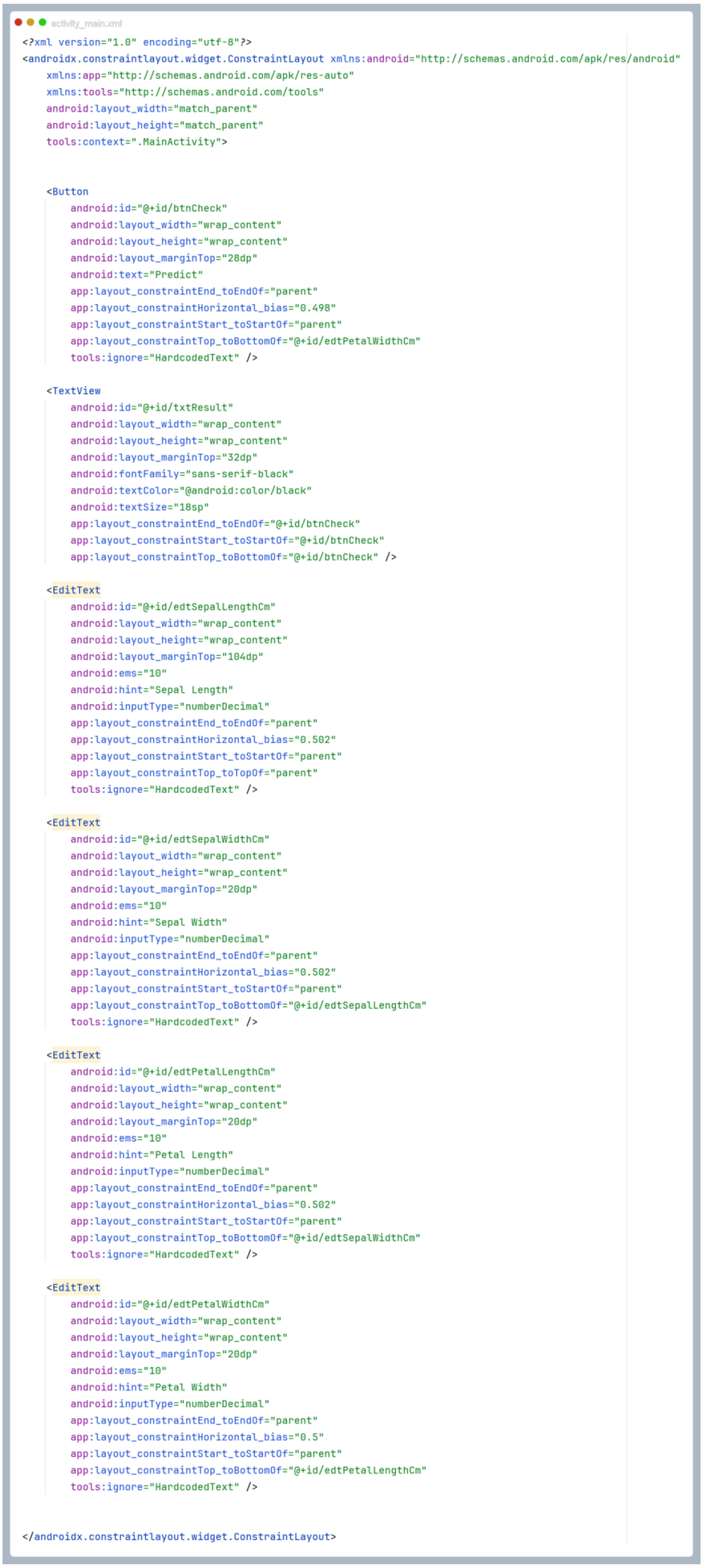


Android

```
app
  manifests
  kotlin+java
  assets
    iris.tflite
  res
    drawable
    layout
      activity_main.xml
    mipmap
    values
    xml
  res (generated)
Gradle Scripts
  build.gradle.kts (Project: MLiris)
  build.gradle.kts (Module :app)
  proguard-rules.pro (ProGuard Rules for ":app")
  gradle.properties (Project Properties)
  gradle-wrapper.properties (Gradle Version)
  libs.versions.toml (Version Catalog "libs")
  local.properties (SDK Location)
  settings.gradle.kts (Project Settings)
```

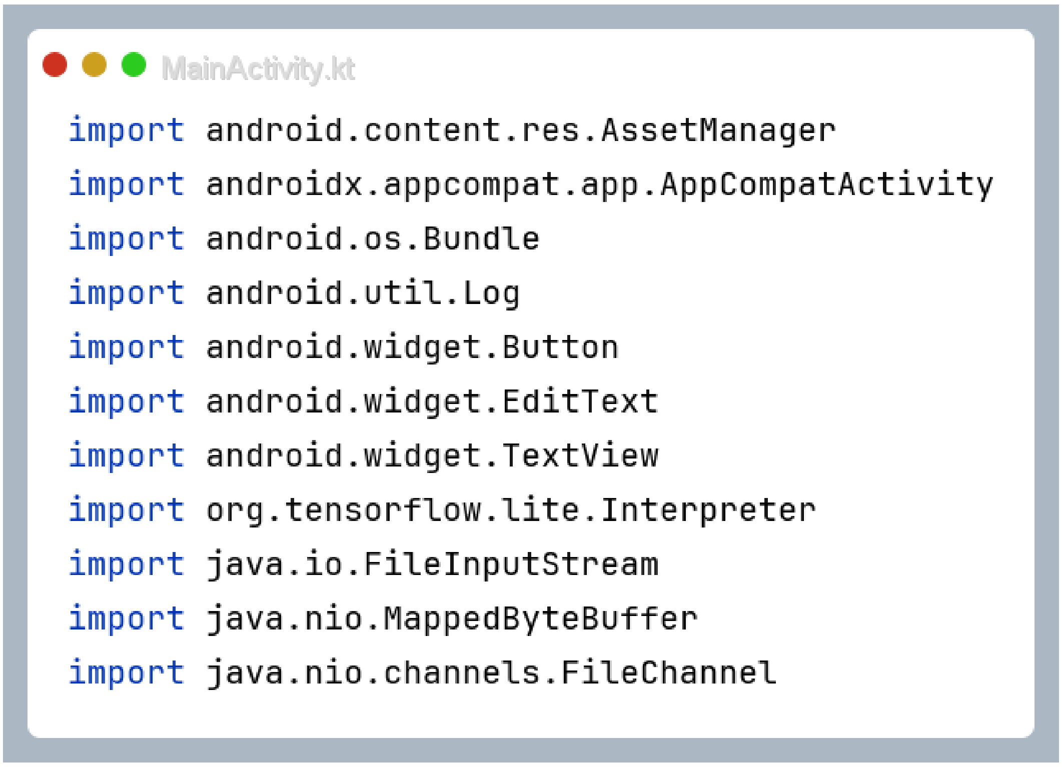
Membuat Layout Aplikasi





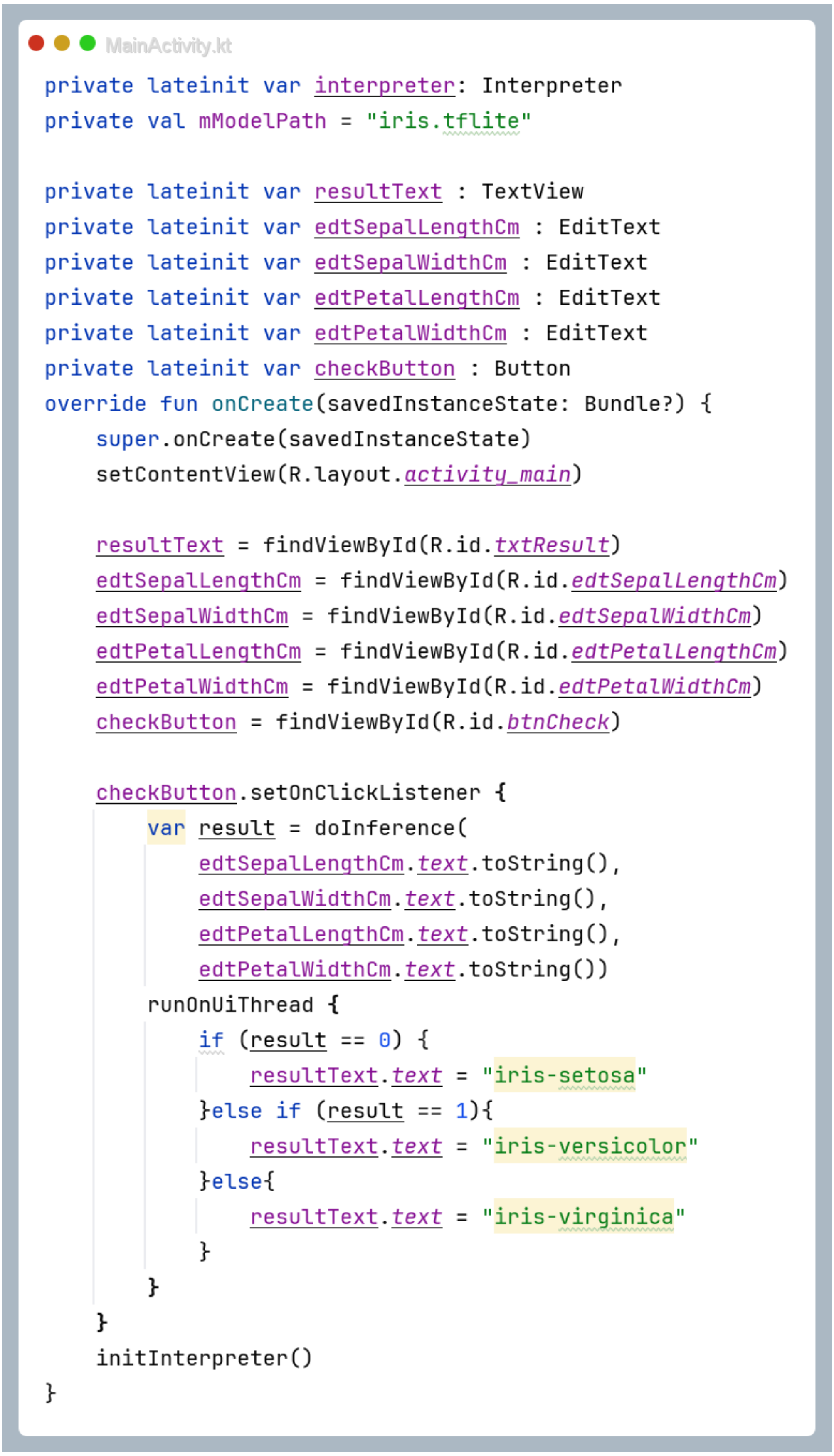
```xml
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">


    <Button
        android:id="@+id/btnCheck"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="28dp"
        android:text="Predict"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.498"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/edtPetalWidthCm"
        tools:ignore="HardcodedText" />

    <TextView
        android:id="@+id/txtResult"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="32dp"
        android:fontFamily="sans-serif-black"
        android:textColor="@android:color/black"
        android:textSize="18sp"
        app:layout_constraintEnd_toEndOf="@+id/btnCheck"
        app:layout_constraintStart_toStartOf="@+id/btnCheck"
        app:layout_constraintTop_toBottomOf="@+id/btnCheck" />

    <EditText
        android:id="@+id/edtSepalLengthCm"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="104dp"
        android:ems="10"
        android:hint="Sepal Length"
        android:inputType="numberDecimal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.502"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        tools:ignore="HardcodedText" />

    <EditText
        android:id="@+id/edtSepalWidthCm"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="20dp"
        android:ems="10"
        android:hint="Sepal Width"
        android:inputType="numberDecimal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.502"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/edtSepalLengthCm"
        tools:ignore="HardcodedText" />

    <EditText
        android:id="@+id/edtPetalLengthCm"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="20dp"
        android:ems="10"
        android:hint="Petal Length"
        android:inputType="numberDecimal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.502"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/edtSepalWidthCm"
        tools:ignore="HardcodedText" />

    <EditText
        android:id="@+id/edtPetalWidthCm"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="20dp"
        android:ems="10"
        android:hint="Petal Width"
        android:inputType="numberDecimal"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.5"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/edtPetalLengthCm"
        tools:ignore="HardcodedText" />


</androidx.constraintlayout.widget.ConstraintLayout>
```

Library yang dibutuhkan dalam aplikasi



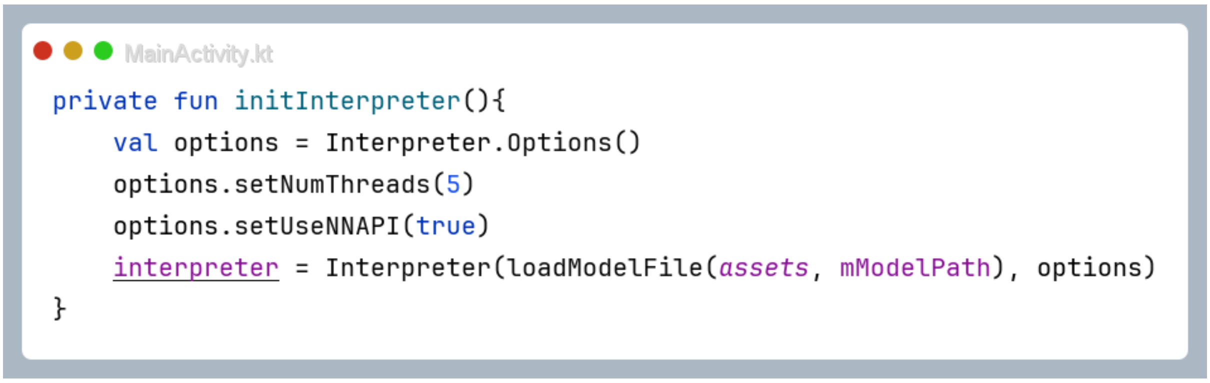
```
import android.content.res.AssetManager
import androidx.appcompat.app.AppCompatActivity
import android.os.Bundle
import android.util.Log
import android.widget.Button
import android.widget.EditText
import android.widget.TextView
import org.tensorflow.lite.Interpreter
import java.io.FileInputStream
import java.nio.MappedByteBuffer
import java.nio.channels.FileChannel
```

Menentukan parameter nilai input dan output



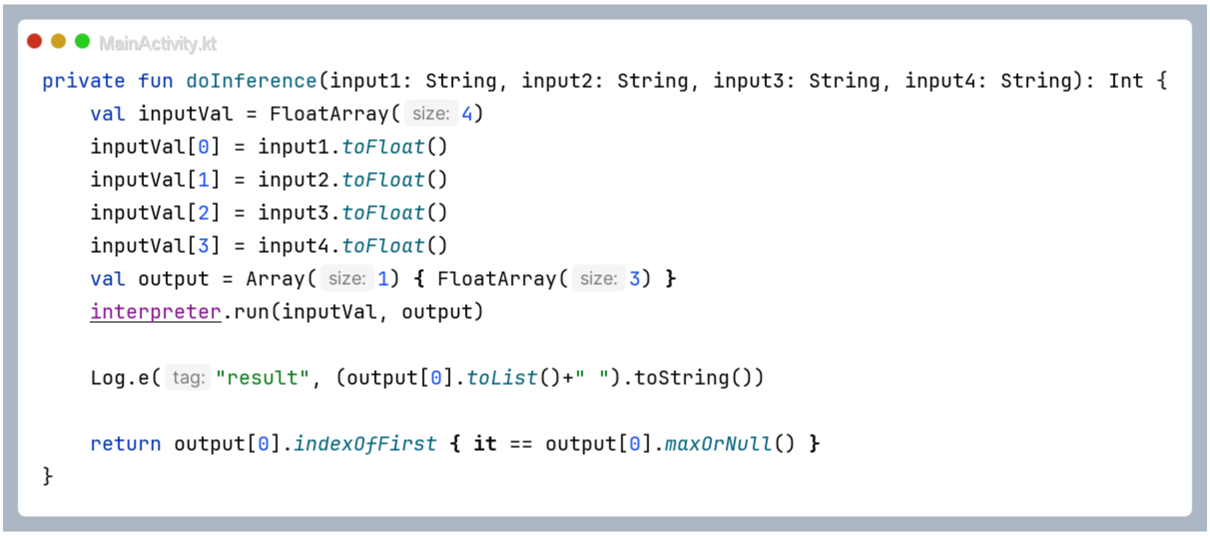
```
private lateinit var interpreter: Interpreter
private val mModelPath = "iris.tflite"

private lateinit var resultText : TextView
private lateinit var edtSepalLengthCm : EditText
private lateinit var edtSepalWidthCm : EditText
private lateinit var edtPetalLengthCm : EditText
private lateinit var edtPetalWidthCm : EditText
private lateinit var checkButton : Button
override fun onCreate(savedInstanceState: Bundle?) {
    super.onCreate(savedInstanceState)
    setContentView(R.layout.activity_main)

    resultText = findViewById(R.id.txtResult)
    edtSepalLengthCm = findViewById(R.id.edtSepalLengthCm)
    edtSepalWidthCm = findViewById(R.id.edtSepalWidthCm)
    edtPetalLengthCm = findViewById(R.id.edtPetalLengthCm)
    edtPetalWidthCm = findViewById(R.id.edtPetalWidthCm)
    checkButton = findViewById(R.id.btnCheck)

    checkButton.setOnClickListener {
        var result = doInference(
            edtSepalLengthCm.text.toString(),
            edtSepalWidthCm.text.toString(),
            edtPetalLengthCm.text.toString(),
            edtPetalWidthCm.text.toString())
        runOnUiThread {
            if (result == 0) {
                resultText.text = "iris-setosa"
            }else if (result == 1){
                resultText.text = "iris-versicolor"
            }else{
                resultText.text = "iris-virginica"
            }
        }
    }
    initInterpreter()
}
```

Membuat Interpreter



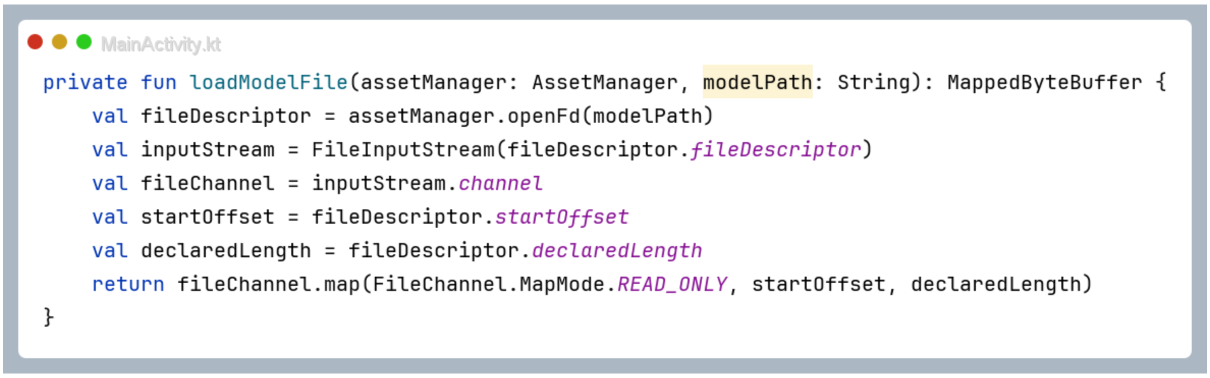
```kotlin
private fun initInterpreter(){
    val options = Interpreter.Options()
    options.setNumThreads(5)
    options.setUseNNAPI(true)
    interpreter = Interpreter(loadModelFile(assets, mModelPath), options)
}
```

Menjalankan Interpreter dengan data input dan output

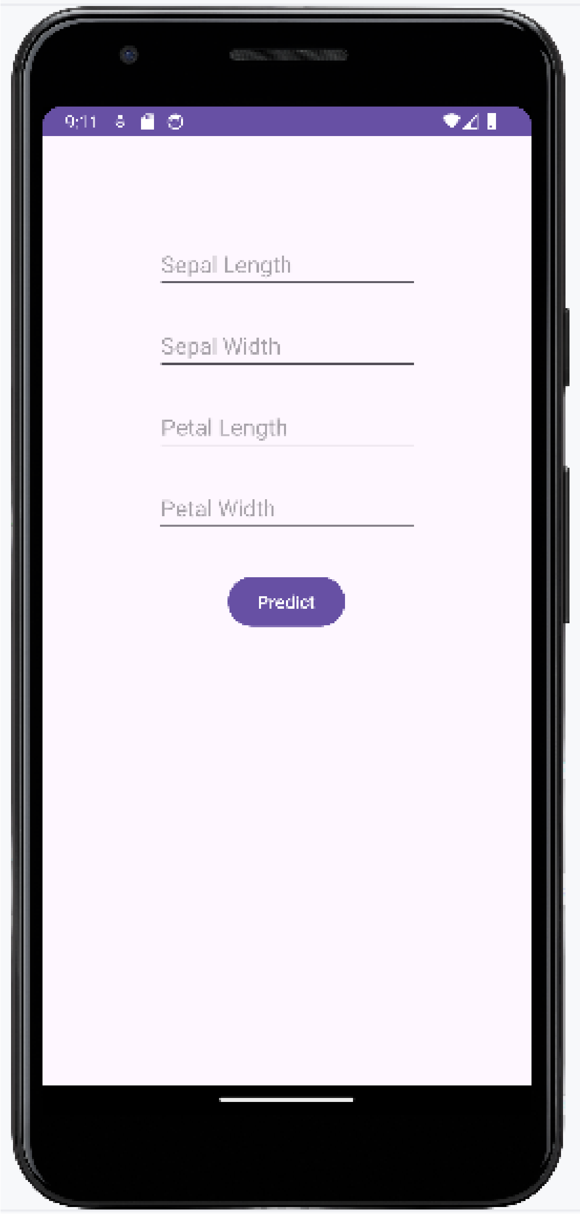


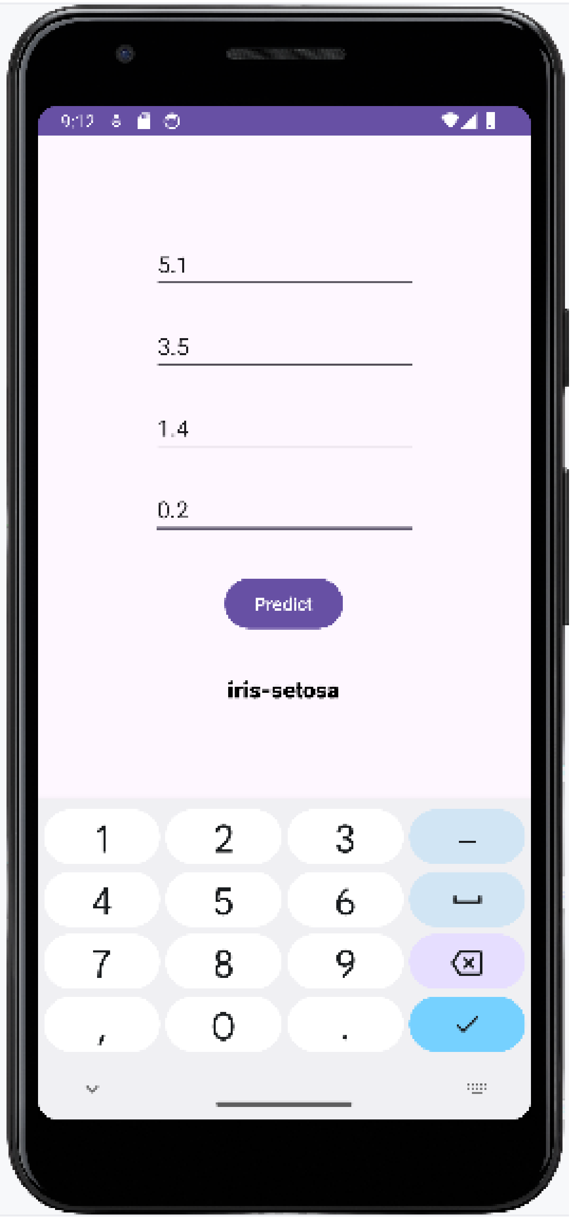
```kotlin
private fun doInference(input1: String, input2: String, input3: String, input4: String): Int {
    val inputVal = FloatArray( size: 4)
    inputVal[0] = input1.toFloat()
    inputVal[1] = input2.toFloat()
    inputVal[2] = input3.toFloat()
    inputVal[3] = input4.toFloat()
    val output = Array( size: 1) { FloatArray( size: 3) }
    interpreter.run(inputVal, output)

    Log.e( tag: "result", (output[0].toList()+" ").toString())

    return output[0].indexOfFirst { it == output[0].maxOrNull() }
}
```

Membuat fungsi untuk menjalankan model



```kotlin
private fun loadModelFile(assetManager: AssetManager, modelPath: String): MappedByteBuffer {
    val fileDescriptor = assetManager.openFd(modelPath)
    val inputStream = FileInputStream(fileDescriptor.fileDescriptor)
    val fileChannel = inputStream.channel
    val startOffset = fileDescriptor.startOffset
    val declaredLength = fileDescriptor.declaredLength
    return fileChannel.map(FileChannel.MapMode.READ_ONLY, startOffset, declaredLength)
}
```





5.1

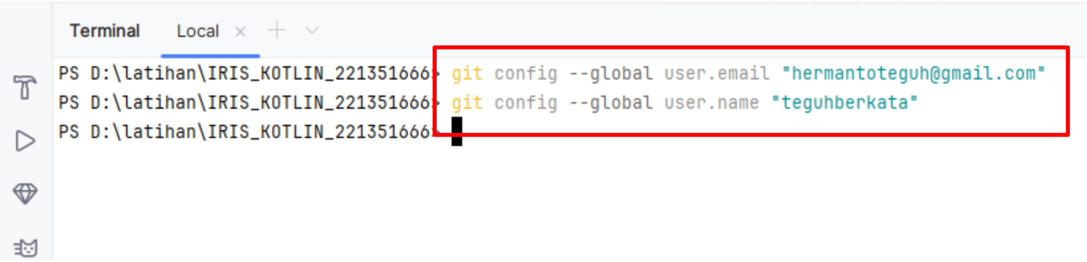
3.5

1.4

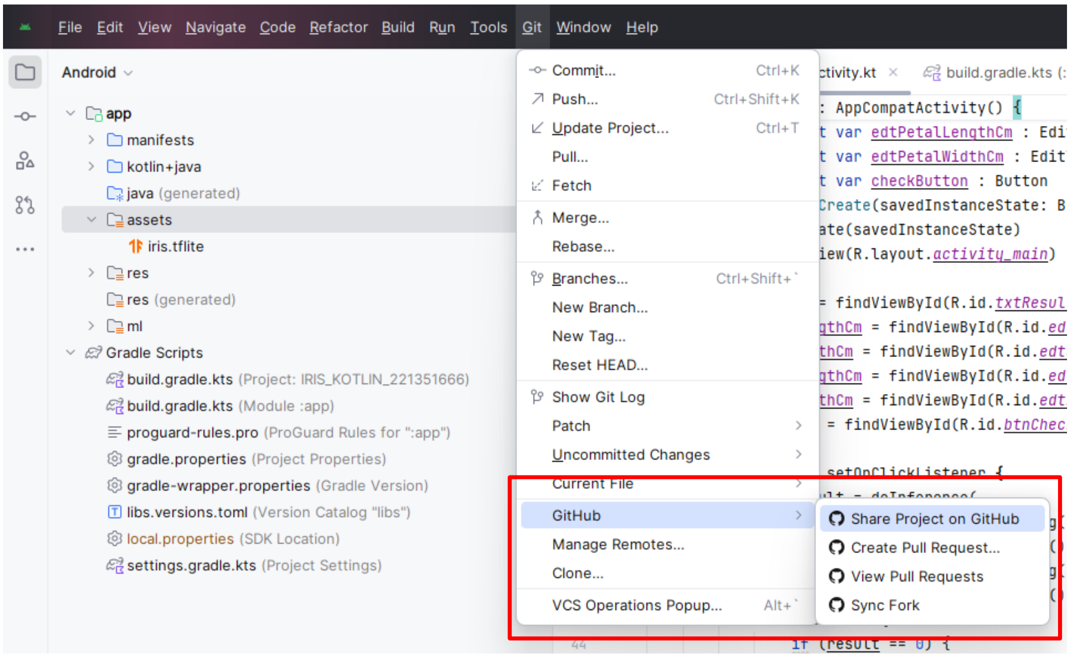
0.2

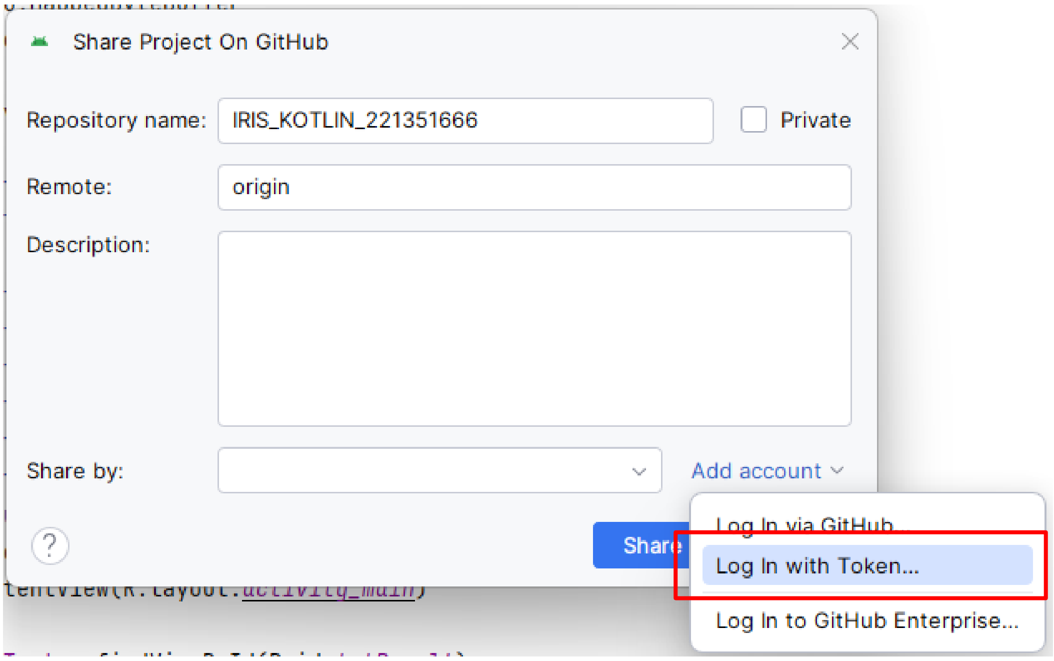
iris-setosa

Upload Project ke Github



```
PS D:\latihan\IRIS_KOTLIN_221351666> git config --global user.email "hermantoteguh@gmail.com"
PS D:\latihan\IRIS_KOTLIN_221351666> git config --global user.name "teguhberkata"
PS D:\latihan\IRIS_KOTLIN_221351666>
```



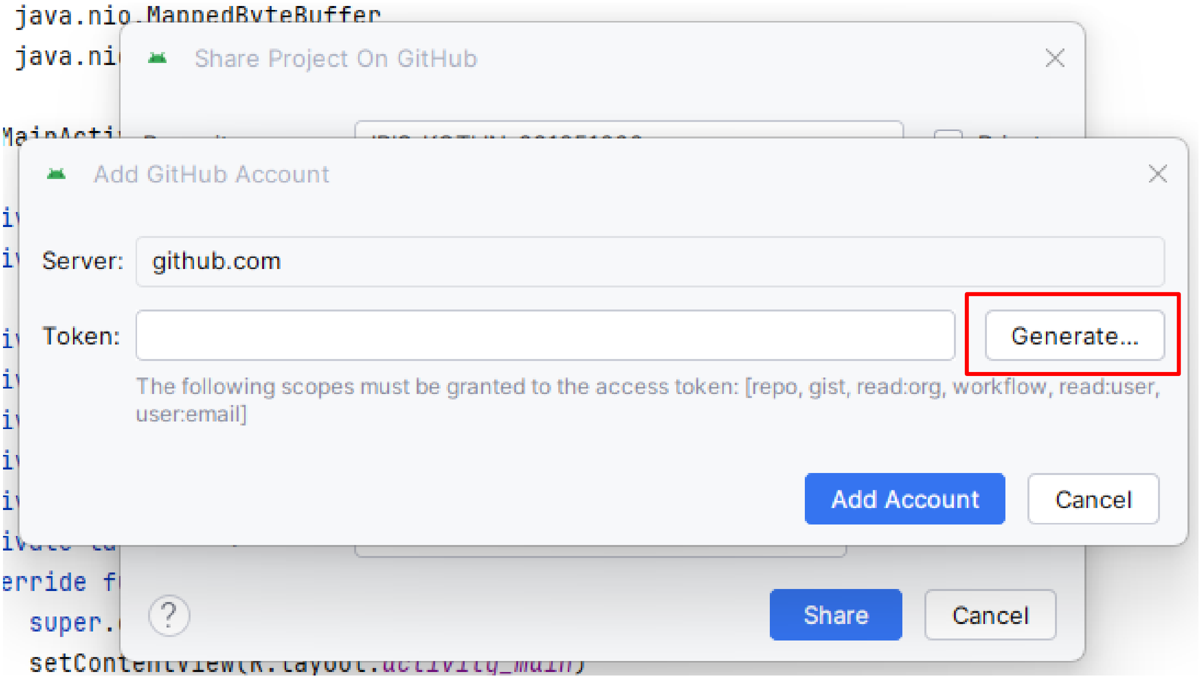


Repository name: IRIS_KOTLIN_221351666 ☐ Private

Remote: origin

Description:

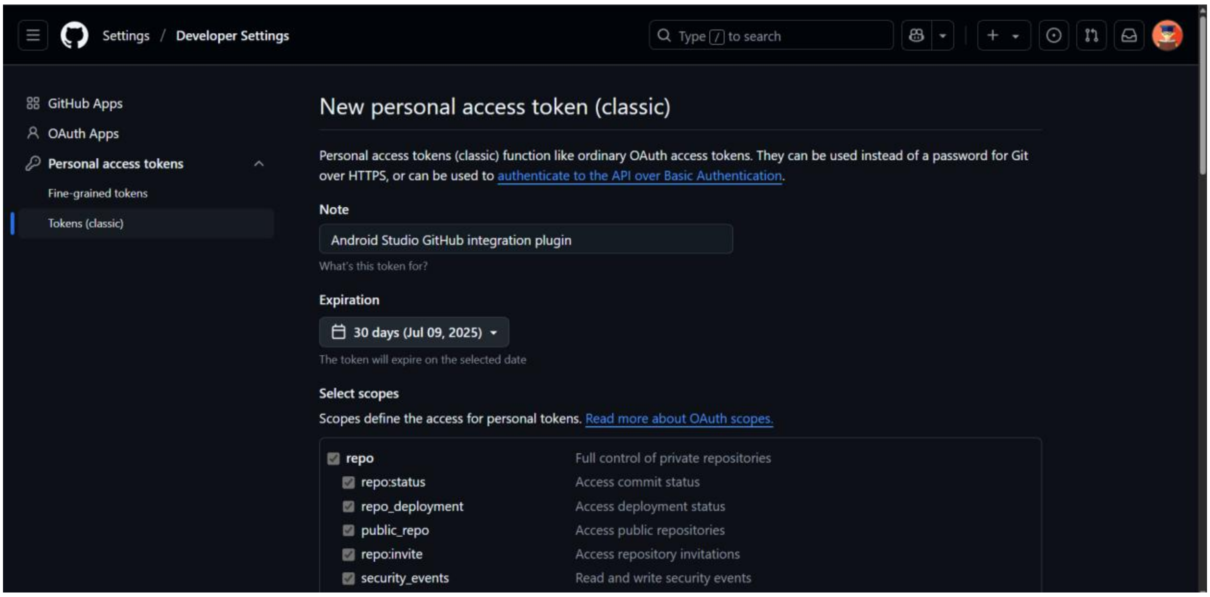
Share by:



Server: github.com

Token:

The following scopes must be granted to the access token: [repo, gist, read:org, workflow, read:user, user:email]



New personal access token (classic)

Personal access tokens (classic) function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to authenticate to the API over Basic Authentication.

Note

Android Studio GitHub integration plugin

What's this token for?

Expiration

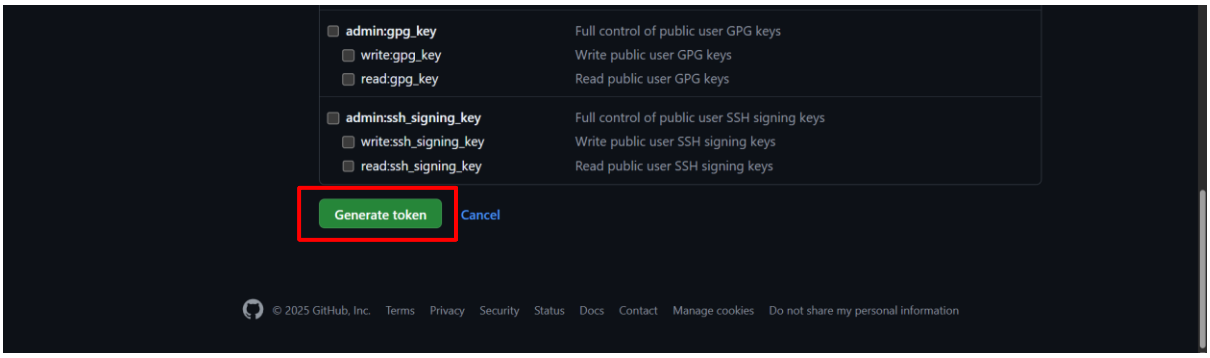
30 days (Jul 09, 2025)

The token will expire on the selected date

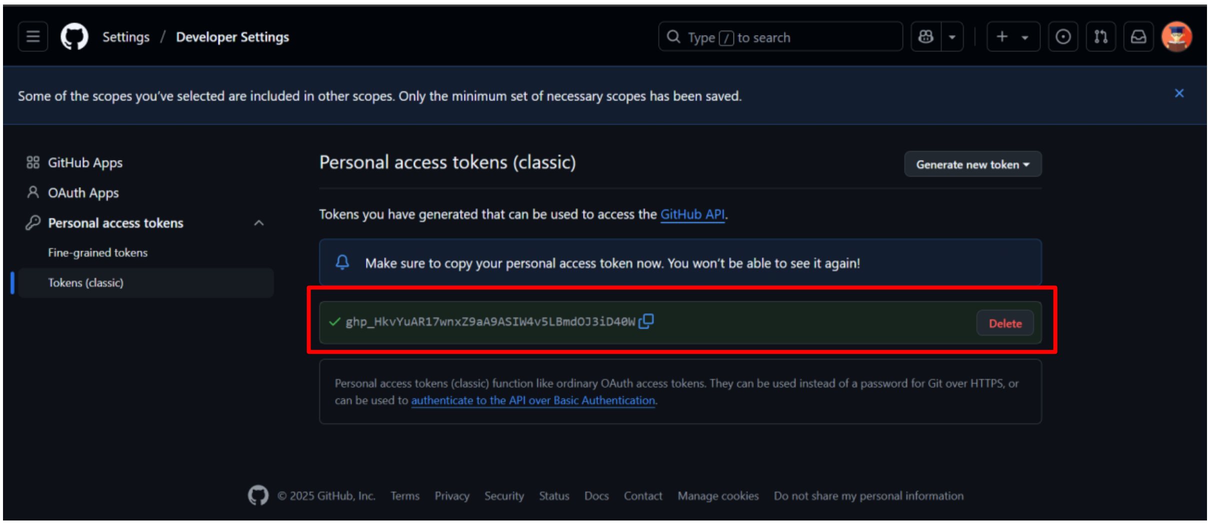
Select scopes

Scopes define the access for personal tokens. Read more about OAuth scopes.

☑ repo	Full control of private repositories
☑ repo:status	Access commit status
☑ repo_deployment	Access deployment status
☑ public_repo	Access public repositories
☑ repo:invite	Access repository invitations
☑ security_events	Read and write security events


Generate token
Cancel
© 2025 GitHub, Inc. Terms Privacy Security Status Docs Contact Manage cookies Do not share my personal information

□ admin:gpg_key	Full control of public user GPG keys
□ write:gpg_key	Write public user GPG keys
□ read:gpg_key	Read public user GPG keys
□ admin:ssh_signing_key	Full control of public user SSH signing keys
□ write:ssh_signing_key	Write public user SSH signing keys
□ read:ssh_signing_key	Read public user SSH signing keys



Some of the scopes you've selected are included in other scopes. Only the minimum set of necessary scopes has been saved.

Personal access tokens (classic)

Tokens you have generated that can be used to access the GitHub API.

Make sure to copy your personal access token now. You won't be able to see it again!

✓ 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

Personal access tokens (classic) function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to authenticate to the API over Basic Authentication.

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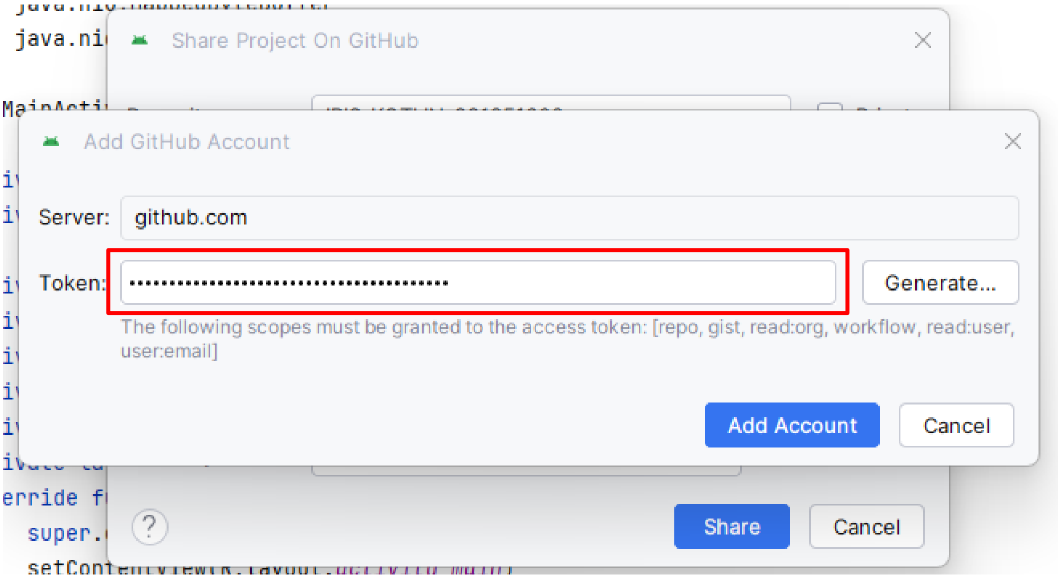
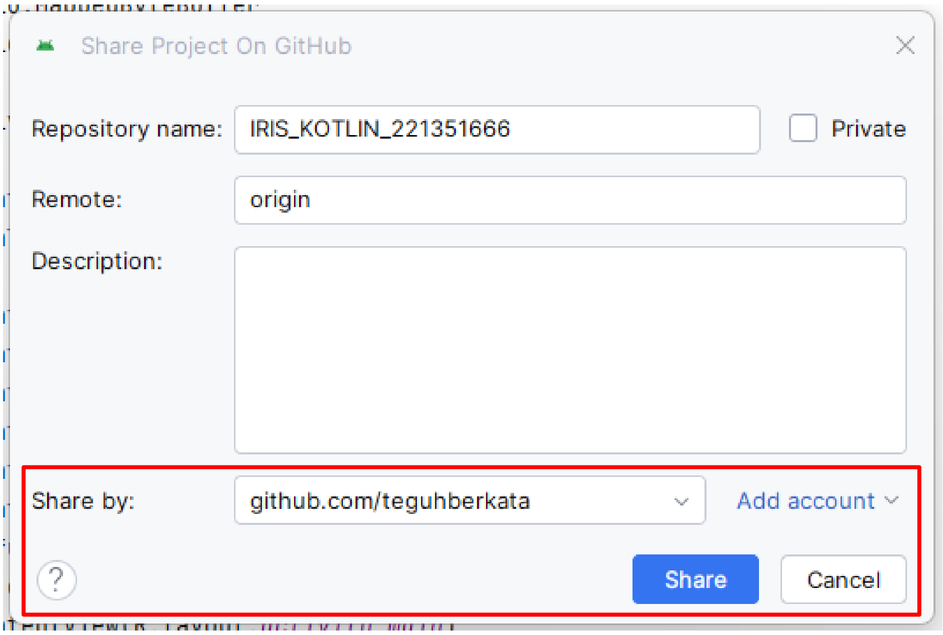

Share Project On GitHub
Add GitHub Account

Server: github.com

Token: ••

The following scopes must be granted to the access token: [repo, gist, read:org, workflow, read:user, user:email]

Add Account
Cancel
Share
Cancel



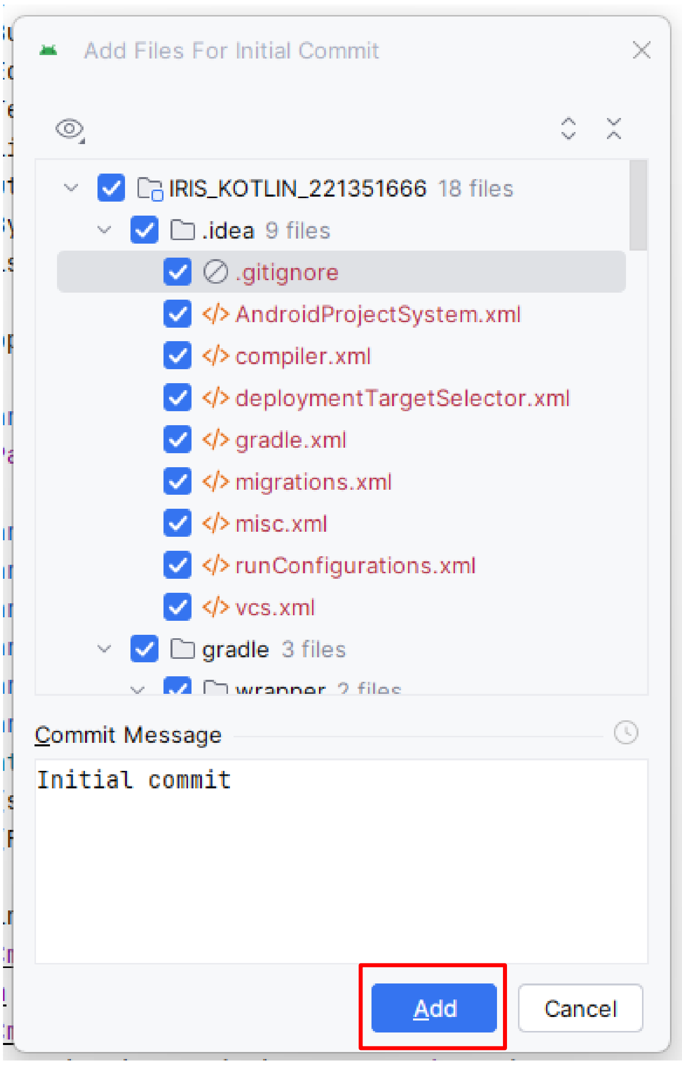
Repository name: IRIS_KOTLIN_221351666

□ Private

Remote: origin

Description:

Share by: github.com/teguhberkata

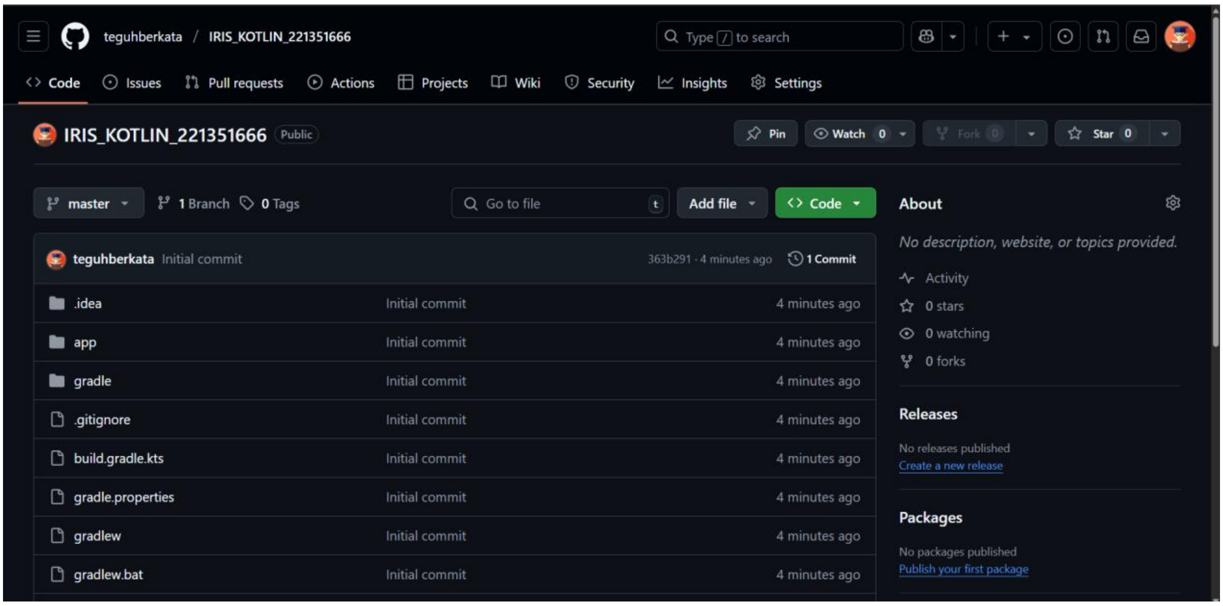


Add Files For Initial Commit

- ☑ IRIS_KOTLIN_221351666 18 files
  - ☑ .idea 9 files
    - ☑ .gitignore
    - ☑ AndroidProjectSystem.xml
    - ☑ compiler.xml
    - ☑ deploymentTargetSelector.xml
    - ☑ gradle.xml
    - ☑ migrations.xml
    - ☑ misc.xml
    - ☑ runConfigurations.xml
    - ☑ vcs.xml
  - ☑ gradle 3 files
    - ☑ wrapper 2 files

Commit Message

```
Initial commit
```



teguhberkata / IRIS_KOTLIN_221351666

IRIS_KOTLIN_221351666 Public

teguhberkata Initial commit 363b291 · 4 minutes ago 1 Commit

.idea	Initial commit	4 minutes ago
app	Initial commit	4 minutes ago
gradle	Initial commit	4 minutes ago
.gitignore	Initial commit	4 minutes ago
build.gradle.kts	Initial commit	4 minutes ago
gradle.properties	Initial commit	4 minutes ago
gradlew	Initial commit	4 minutes ago
gradlew.bat	Initial commit	4 minutes ago

About

No description, website, or topics provided.

Activity
0 stars
0 watching
0 forks

Releases

No releases published
Create a new release

Packages

No packages published
Publish your first package