# CSE 162 - Lab 3
# Activity Recognition

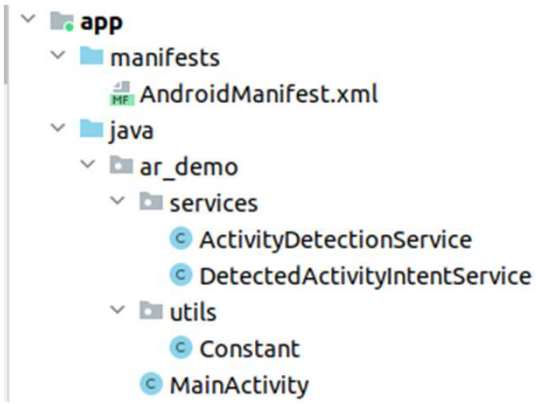
# Goal

- Display the current activity of the user
  - Learn to use the Google Activity Recognition API

# Overview of tasks

- obtain the permissions
- register for activity updates
  - create pending intents
- deregister for activity updates
- process activity events

# Take care of these files



# Obtain permissions

# AndroidManifest.xml

- AndroidManifest.xml file:
  - Request permission
  - declare activity
  - declare services

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="ar_demo">

    <uses-permission android:name="com.google.android.gms.permission.ACTIVITY_RECOGNITION" />

    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="AR-Demo"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:theme="@style/AppTheme">
        <activity
            android:name=".MainActivity"
            android:screenOrientation="fullSensor">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>

        <service android:name=".services.DetectedActivityIntentService" />
        <service android:name=".services.ActivityDetectionService" />

    </application>

</manifest>
```

# UI design

- activity_main.xml (1)

```xml
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    tools:context=".MainActivity">
    <RelativeLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_margin="16dp">
        <TextView
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentStart="true"
            android:layout_alignStart="@id/text_label"
            android:text="Activity Label:"
            android:textStyle="bold" />
        <TextView
            android:id="@+id/text_label"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentEnd="true" />
    </RelativeLayout>
```

- activity_main.xml (2)

```
    <RelativeLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_margin="16dp">
        <TextView
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentStart="true"
            android:layout_alignStart="@id/text_confidence"
            android:text="Confidence:"
            android:textStyle="bold" />
        <TextView
            android:id="@+id/text_confidence"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_alignParentEnd="true" />
    </RelativeLayout>
</LinearLayout>
```

register for activity updates

# ActivityDetectionService.java

- To start receiving notifications about activity transitions, you must implement the following:
  - An requestActivityUpdatesHandler method that specifies what activities and how frequently to request.
  - A PendingIntent callback where your app receives notifications. For more information, see Using a pending intent.

# Imports for ActivityDetectionService.java

```java
package ar_demo.services;

import android.app.PendingIntent;
import android.app.Service;
import android.content.Intent;
import android.os.IBinder;
import androidx.annotation.NonNull;
import androidx.annotation.Nullable;
import android.util.Log;

import com.google.android.gms.location.ActivityRecognitionClient;
import com.google.android.gms.tasks.OnFailureListener;
import com.google.android.gms.tasks.OnSuccessListener;
import com.google.android.gms.tasks.Task;

import ar_demo.utils.Constant;
```

Google activity recognition imports

# Initialize the update service

- in ar_demo/services/ActivityDetectionService.java, implement:

Create the activity recognition client

Create the pending intent

Call the handler

```
public int onStartCommand(Intent intent, int flags, int startId) {
    super.onStartCommand(intent, flags, startId);

    Log.d(TAG, msg: "onStartCommand()");
    mActivityRecognitionClient = new ActivityRecognitionClient( context: this);
    Intent mIntentService = new Intent( packageContext: this, DetectedActivityIntentService.class);
    // FLAG_UPDATE_CURRENT indicates that if the described PendingIntent already exists,
    // then keep it but replace its extra data with what is in this new Intent.
    mPendingIntent = PendingIntent.getService( context: this,
            requestCode: 1, mIntentService, PendingIntent.FLAG_UPDATE_CURRENT);
    requestActivityUpdatesHandler();

    return START_STICKY;
}
```

- You can register for activity updates by passing your update interval and your PendingIntent object to the requestActivityUpdates() method.
- The requestActivityUpdates() method returns a Task object that you can check for success or failure

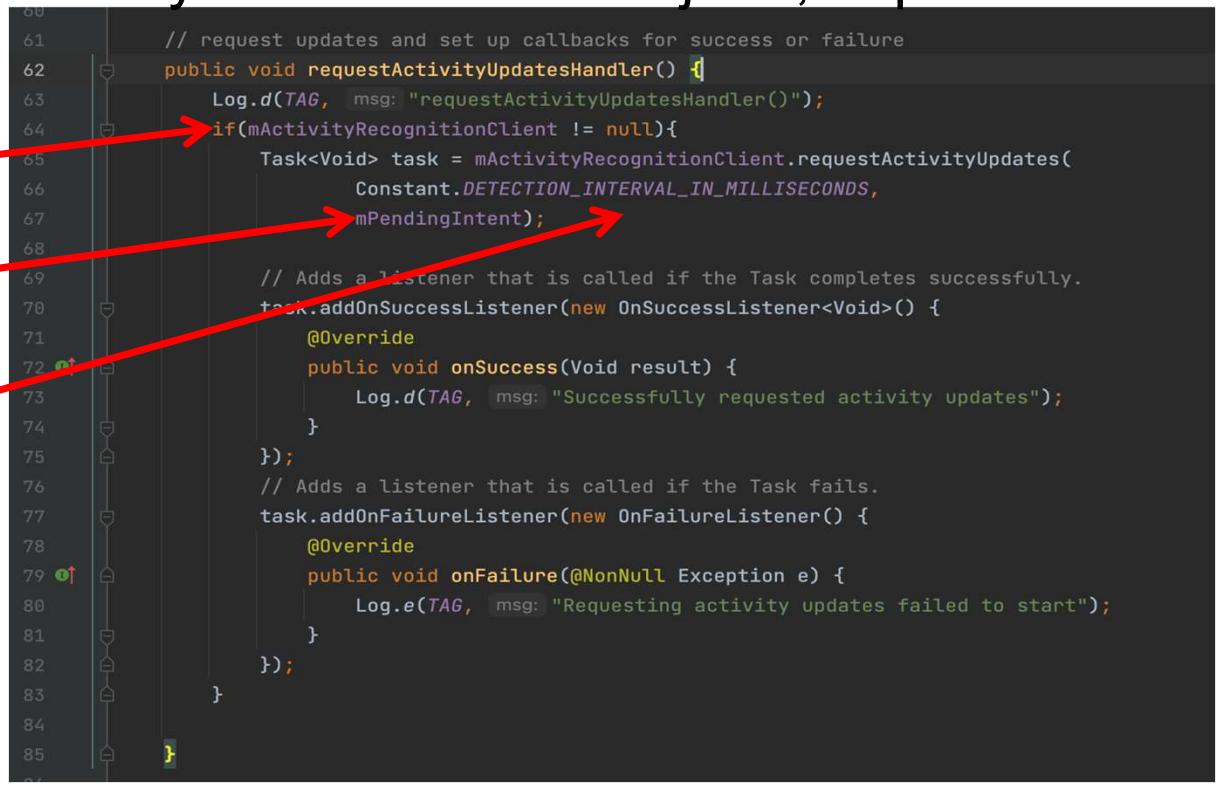
# Implement requestActivityUpdatesHandler

- in ar_demo/services/ActivityDetectionService.java, implement:

activity recognition client

the pending intent

A constant value to control the frequency of activity updates. To be seen soon.



```
61      // request updates and set up callbacks for success or failure
62      public void requestActivityUpdatesHandler() {
63          Log.d(TAG, msg: "requestActivityUpdatesHandler()");
64          if(mActivityRecognitionClient != null){
65              Task<Void> task = mActivityRecognitionClient.requestActivityUpdates(
66                      Constant.DETECTION_INTERVAL_IN_MILLISECONDS,
67                      mPendingIntent);
68
69              // Adds a listener that is called if the Task completes successfully.
70              task.addOnSuccessListener(new OnSuccessListener<Void>() {
71                  @Override
72                  public void onSuccess(Void result) {
73                      Log.d(TAG, msg: "Successfully requested activity updates");
74                  }
75              });
76              // Adds a listener that is called if the Task fails.
77              task.addOnFailureListener(new OnFailureListener() {
78                  @Override
79                  public void onFailure(@NonNull Exception e) {
80                      Log.e(TAG, msg: "Requesting activity updates failed to start");
81                  }
82              });
83          }
84
85      }
```

# Deregister activity recognition updates

```
87      // remove the activity requested updates from Google play.
88      @Override
89      public void onDestroy() {
90          super.onDestroy();
91          // need to remove the request to Google play services. Brings down the connection.
92          removeActivityUpdatesHandler();
93      }
94
95      // remove updates and set up callbacks for success or failure
96      public void removeActivityUpdatesHandler() {
97          if(mActivityRecognitionClient != null){
98              Task<Void> task = mActivityRecognitionClient.removeActivityUpdates(
99                      mPendingIntent);
100             // Adds a listener that is called if the Task completes successfully.
101             task.addOnSuccessListener(new OnSuccessListener<Void>() {
102                 @Override
103                 public void onSuccess(Void result) {
104                     Log.d(TAG,  msg: "Removed activity updates successfully!");
105                 }
106             });
107             // Adds a listener that is called if the Task fails.
108             task.addOnFailureListener(new OnFailureListener() {
109                 @Override
110                 public void onFailure(@NonNull Exception e) {
111                     Log.e(TAG,  msg: "Failed to remove activity updates!");
112                 }
113             });
114         }
115     }
116 }
```

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```
19
20  public class ActivityDetectionService extends Service {
21      private static final String TAG = ActivityDetectionService.class.getSimpleName();
22
23      private PendingIntent mPendingIntent;
24      private ActivityRecognitionClient mActivityRecognitionClient;
25
26      public ActivityDetectionService() {
27          //Log.d(TAG, "ActivityDetectionService()");
28
29      }
30
31      @Nullable
32      @Override
33      public IBinder onBind(Intent intent) {
34          Log.d(TAG, msg: "onBind()");
35          return null;
36      }
37
38      @Override
39      public void onCreate() {
40          super.onCreate();
41          Log.d(TAG, msg: "onCreate()");
42      }
43
```

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```java
@SuppressLint("UnspecifiedImmutableFlag")
@Override
public int onStartCommand(Intent intent, int flags, int startId) {
    super.onStartCommand(intent, flags, startId);

    Log.d(TAG, msg: "onStartCommand()");
    mActivityRecognitionClient = new ActivityRecognitionClient( context: this);
    Intent mIntentService = new Intent( packageContext: this, DetectedActivityIntentService.class);
    // FLAG_UPDATE_CURRENT indicates that if the described PendingIntent already exists,
    // then keep it but replace its extra data with what is in this new Intent.
    mPendingIntent = PendingIntent.getService( context: this,
            requestCode: 1, mIntentService, PendingIntent.FLAG_UPDATE_CURRENT);
    requestActivityUpdatesHandler();

    return START_STICKY;
}

// request updates and set up callbacks for success or failure
public void requestActivityUpdatesHandler() {
    Log.d(TAG, msg: "requestActivityUpdatesHandler()");
    if(mActivityRecognitionClient != null){
        Task<Void> task = mActivityRecognitionClient.requestActivityUpdates(
                Constant.DETECTION_INTERVAL_IN_MILLISECONDS,
                mPendingIntent);

        // Adds a listener that is called if the Task completes successfully.
        task.addOnSuccessListener(new OnSuccessListener<Void>() {
            @Override
            public void onSuccess(Void result) {
                Log.d(TAG, msg: "Successfully requested activity updates");
            }
        });
        // Adds a listener that is called if the Task fails.
        task.addOnFailureListener(new OnFailureListener() {
            @Override
            public void onFailure(@NonNull Exception e) {
                Log.e(TAG, msg: "Requesting activity updates failed to start");
            }
        });
    }

}
```

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```
86
87      // remove the activity requested updates from Google play.
88      @Override
89      public void onDestroy() {
90          super.onDestroy();
91          // need to remove the request to Google play services. Brings down the connection.
92          removeActivityUpdatesHandler();
93      }
94
95      // remove updates and set up callbacks for success or failure
96      public void removeActivityUpdatesHandler() {
97          if(mActivityRecognitionClient != null){
98              Task<Void> task = mActivityRecognitionClient.removeActivityUpdates(
99                      mPendingIntent);
100             // Adds a listener that is called if the Task completes successfully.
101             task.addOnSuccessListener(new OnSuccessListener<Void>() {
102                 @Override
103                 public void onSuccess(Void result) {
104                     Log.d(TAG, msg: "Removed activity updates successfully!");
105                 }
106             });
107             // Adds a listener that is called if the Task fails.
108             task.addOnFailureListener(new OnFailureListener() {
109                 @Override
110                 public void onFailure(@NonNull Exception e) {
111                     Log.e(TAG, msg: "Failed to remove activity updates!");
112                 }
113             });
114         }
115     }
116 }
117
```

# Define the update interval

ar_demo/utils/Constant.java

```java
public class Constant {

    3 usages
    public static final String BROADCAST_DETECTED_ACTIVITY = "activity_intent";
    // the desired time between activity detections. Larger values will result in fewer activity
    // detections while improving battery life. A value of 0 will result in activity detections
    // at the fastest possible rate.
    1 usage
    public static final long DETECTION_INTERVAL_IN_MILLISECONDS = 1000; // every N seconds
}
```

# Process activity events

# DetectedActivityIntentService.java

# Imports for DetectedActivityIntentService.java

```java
package ar_demo.services;

import android.app.IntentService;
import android.content.Intent;
import androidx.localbroadcastmanager.content.LocalBroadcastManager;
import android.util.Log;

import com.google.android.gms.location.ActivityRecognitionResult;
import com.google.android.gms.location.DetectedActivity;

import java.util.List;

import ar_demo.utils.Constant;

```

# Implement the pending intent

- create the file ar_demo/services/DetectedActivityIntentService.java

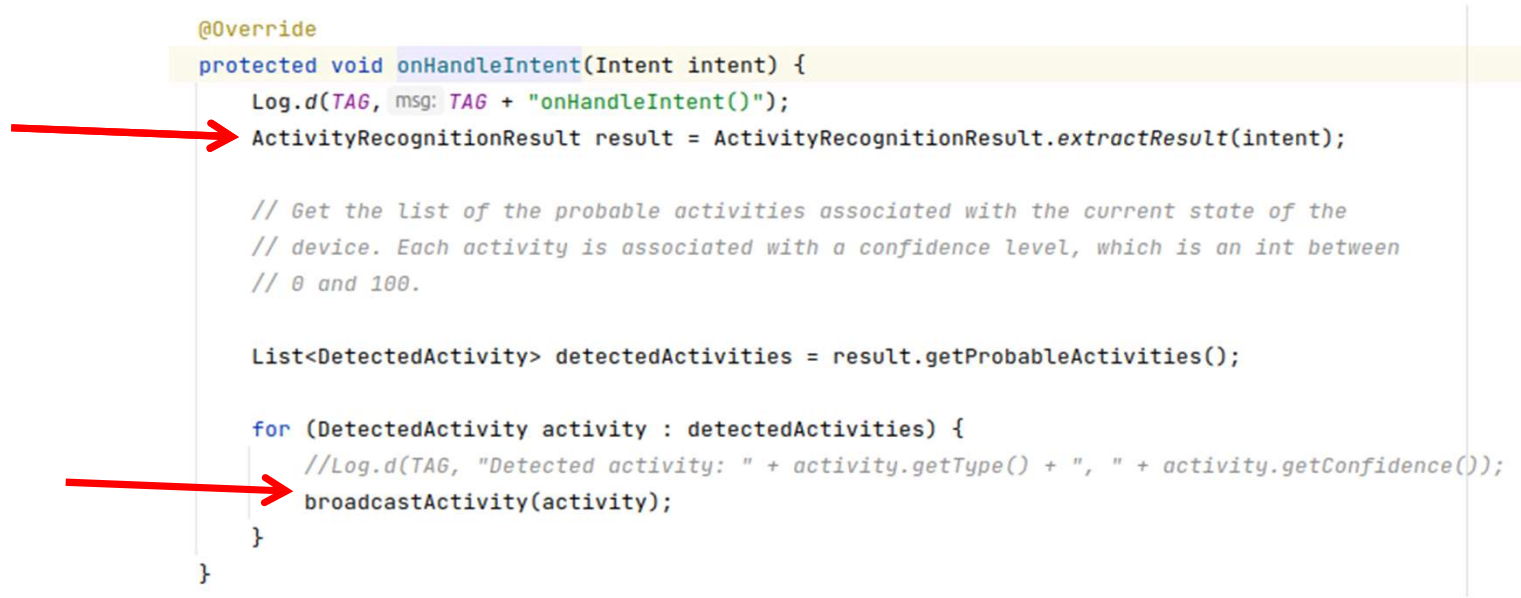
- Create a service:

```
3 usages
public class DetectedActivityIntentService extends IntentService
```

- override onHandleIntent() method

Get the recognition results

send the result out



```
@Override
protected void onHandleIntent(Intent intent) {
    Log.d(TAG, msg: TAG + "onHandleIntent()");
    ActivityRecognitionResult result = ActivityRecognitionResult.extractResult(intent);

    // Get the list of the probable activities associated with the current state of the
    // device. Each activity is associated with a confidence level, which is an int between
    // 0 and 100.

    List<DetectedActivity> detectedActivities = result.getProbableActivities();

    for (DetectedActivity activity : detectedActivities) {
        //Log.d(TAG, "Detected activity: " + activity.getType() + ", " + activity.getConfidence());
        broadcastActivity(activity);
    }
}
```

- create an inent and send out the activity info

```
private void broadcastActivity(DetectedActivity activity) {
    // Log.d(TAG,TAG+ "broadcastActivity()");
    Intent intent = new Intent(Constant.BROADCAST_DETECTED_ACTIVITY);
    intent.putExtra( name: "type", activity.getType());
    intent.putExtra( name: "confidence", activity.getConfidence());
    LocalBroadcastManager.getInstance( context: this).sendBroadcast(intent);
}
```

Overview of DetectedActivityIntentService.java

```java
public class DetectedActivityIntentService extends IntentService {
    3 usages
    protected static final String TAG = DetectedActivityIntentService.class.getSimpleName();

    public DetectedActivityIntentService() {
        super(TAG);
        // Log.d(TAG,TAG + "DetectedActivityIntentService()");
    }

    @Override
    public void onCreate() {
        super.onCreate();
        // Log.d(TAG,TAG + "onCreate()");

    }

    @Override
    protected void onHandleIntent(Intent intent) {
        Log.d(TAG, msg: TAG + "onHandleIntent()");
        ActivityRecognitionResult result = ActivityRecognitionResult.extractResult(intent);

        // Get the list of the probable activities associated with the current state of the
        // device. Each activity is associated with a confidence level, which is an int between
        // 0 and 100.

        List<DetectedActivity> detectedActivities = result.getProbableActivities();

        for (DetectedActivity activity : detectedActivities) {
            //Log.d(TAG, "Detected activity: " + activity.getType() + ", " + activity.getConfidence());
            broadcastActivity(activity);
        }
    }

    1 usage
    private void broadcastActivity(DetectedActivity activity) {
        // Log.d(TAG,TAG+ "broadcastActivity()");
        Intent intent = new Intent(Constant.BROADCAST_DETECTED_ACTIVITY);
        intent.putExtra( name: "type", activity.getType());
        intent.putExtra( name: "confidence", activity.getConfidence());
        LocalBroadcastManager.getInstance( context: this).sendBroadcast(intent);
    }
}
```

# MainActivity.java

# Import section for MainActivity.java

```java
package ar_demo;

import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
import android.content.IntentFilter;
import androidx.localbroadcastmanager.content.LocalBroadcastManager;
import androidx.appcompat.app.AppCompatActivity;
import android.os.Bundle;
import android.util.Log;
import android.widget.TextView;

import com.google.android.gms.location.DetectedActivity;

import ar_demo.services.ActivityDetectionService;
import ar_demo.utils.Constant;
```

# Handle the activity intent in ar_demo/MainActivity.java

Create intent receiver:

```
57      BroadcastReceiver mActivityBroadcastReceiver = new BroadcastReceiver() {
58          @Override
59      @   public void onReceive(Context context, Intent intent) {
60              // Log.d(TAG, "onReceive()");
61              if (intent.getAction().equals(Constant.BROADCAST_DETECTED_ACTIVITY)) {
62                  int type = intent.getIntExtra( name: "type",  defaultValue: -1);
63                  int confidence = intent.getIntExtra( name: "confidence",  defaultValue: 0);
64                  handleUserActivity(type, confidence);
65              }
66          }
67      };
```

- Implement handleUserActivity()

```
private void handleUserActivity(int type, int confidence) {
    String label = "Unknown";
    switch (type) {
        case DetectedActivity.IN_VEHICLE: {
            label = "In_Vehicle";
            break;
        }
        case DetectedActivity.ON_BICYCLE: {
            label = "On_Bicycle";
            break;
        }
        case DetectedActivity.ON_FOOT: {
            label = "On_Foot";
            break;
        }
        case DetectedActivity.RUNNING: {
            label = "Running";
            break;
        }
        case DetectedActivity.STILL: {
            label = "Still";
            break;
        }
        case DetectedActivity.TILTING: {
            label = "Tilting";
            break;
        }
        case DetectedActivity.WALKING: {
            label = "Walking";
            break;
        }
        case DetectedActivity.UNKNOWN: {
            break;
        }
    }
    Log.d(TAG, msg: "broadcast:onReceive(): Activity is " + label
            + " and confidence level is: " + confidence);
    mTextARLabel.setText(label);
    mTextConfidence.setText(confidence+"");

}
```

- in the main activity, call the activty detection service

```
// register the RX and start up the ActivityDetectionService service
@Override
protected void onStart() {
    super.onStart();
    Log.d(TAG,  msg: "onStart():start ActivityDetectionService");
    LocalBroadcastManager.getInstance( context: this).registerReceiver(mActivityBroadcastReceiver,
            new IntentFilter(Constant.BROADCAST_DETECTED_ACTIVITY));

    startService(new Intent( packageContext: this, ActivityDetectionService.class));
}
```

- Don’t forget common tasks, including unregistering listeners, initiate UI, etc

# Overview of MainActivity.java

```java
public class MainActivity extends AppCompatActivity {

    4 usages
    public static final String TAG = MainActivity.class.getSimpleName();


    2 usages
    private TextView mTextARLabel;
    2 usages
    private TextView mTextConfidence;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        Log.d(TAG, msg: "onCreate()");
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        mTextARLabel = findViewById(R.id.text_label);
        mTextConfidence = findViewById(R.id.text_confidence);
    }

    // register the RX and start up the ActivityDetectionService service
    @Override
    protected void onStart() {
        super.onStart();
        Log.d(TAG, msg: "onStart():start ActivityDetectionService");
        LocalBroadcastManager.getInstance( context: this).registerReceiver(mActivityBroadcastReceiver,
                new IntentFilter(Constant.BROADCAST_DETECTED_ACTIVITY));

        startService(new Intent( packageContext: this, ActivityDetectionService.class));
    }
```

# Overview of MainActivity.java (2)

```
46
47      // unregister the RX and stop up the ActivityDetectionService service
48      @Override
49      protected void onPause() {
50          super.onPause();
51          Log.d(TAG, msg: "onPause():stop ActivityDetectionService");
52          if(mActivityBroadcastReceiver != null){
53              stopService(new Intent( packageContext: this, ActivityDetectionService.class));
54              LocalBroadcastManager.getInstance(this).unregisterReceiver(mActivityBroadcastReceiver);
55          }
56      }
57      BroadcastReceiver mActivityBroadcastReceiver = new BroadcastReceiver() {
58          @Override
59          public void onReceive(Context context, Intent intent) {
60              // Log.d(TAG, "onReceive()");
61              if (intent.getAction().equals(Constant.BROADCAST_DETECTED_ACTIVITY)) {
62                  int type = intent.getIntExtra( name: "type", defaultValue: -1);
63                  int confidence = intent.getIntExtra( name: "confidence", defaultValue: 0);
64                  handleUserActivity(type, confidence);
65              }
66          }
67      };
```

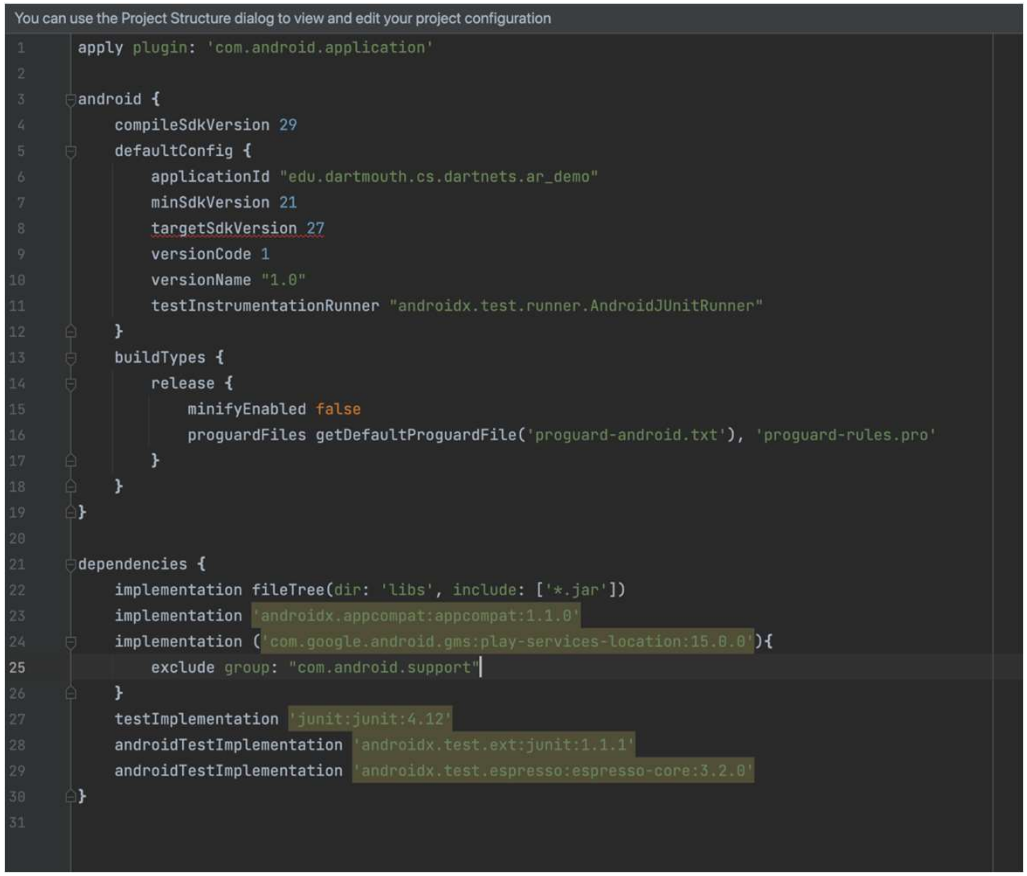
# Overview of MainActivity.java (3)

```java
    private void handleUserActivity(int type, int confidence) {
        String label = "Unknown";
        switch (type) {
            case DetectedActivity.IN_VEHICLE: {
                label = "In_Vehicle";
                break;
            }
            case DetectedActivity.ON_BICYCLE: {
                label = "On_Bicycle";
                break;
            }
            case DetectedActivity.ON_FOOT: {
                label = "On_Foot";
                break;
            }
            case DetectedActivity.RUNNING: {
                label = "Running";
                break;
            }
            case DetectedActivity.STILL: {
                label = "Still";
                break;
            }
            case DetectedActivity.TILTING: {
                label = "Tilting";
                break;
            }
            case DetectedActivity.WALKING: {
                label = "Walking";
                break;
            }
            case DetectedActivity.UNKNOWN: {
                break;
            }
        }
        Log.d(TAG, msg: "broadcast:onReceive(): Activity is " + label
                + " and confidence level is: " + confidence);
        mTextARLabel.setText(label);
        mTextConfidence.setText(confidence);

    }

}
```

# Build gradle file



# Final App