



Multi-Modal Biometric Authentication

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Overview: The term Biometric made with two terms Bio means life and metrics means to measure. Biometric authentication system are becoming popular due to increased security and proven its superior performance due to increasing demand in society. It uses measurable human physiological or behavioral characteristics to verify identity of individual and has the ability to distinguish between an authorized person and fake ones. Biometric system improved the recognition technique by determining the physiological, behavioural traits. Physiological characteristics which remain constant lifetime include fingerprint, face, DNA, iris etc. and each of these properties are remarkable to every person. Behavioral traits are signature, voice; speech patterns, gait, keystroke etc which amend with time due to age, disease, fractured, accident and several other things affect behavior. Biometric features are unique for every individual so cannot be forgotten by users and outperforms technology. Even though it used in every field like in forensic, commercial, medical, financial institution, border security, and so on but has its drawbacks in terms of cost, accuracy, throughput and ease of use. Biometrics based on single peculiarity is known as unimodal system with a variety of problems like noisy data, false rejection, intra class variation, fake biometric trait, non universality, inter-class similarity, spoofy attacks. To overwhelm these problems multimodal biometrics is used. In multimodal different cues or traits are collected from different sources of same person.

1. IMPORTING LIBRARIES:

```

package com.example.myapplication;

import android.annotation.SuppressLint;
import androidx.biometric.BiometricPrompt;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.TextView;

import androidx.annotation.NonNull;
import androidx.appcompat.app.AppCompatActivity;
import androidx.biometric.BiometricPrompt.PromptInfo;
import androidx.core.content.ContextCompat;

import java.util.concurrent.Executor;

public class MainActivity extends AppCompatActivity {
    Button btnAuth;
    TextView tvAuthStatus;

    private Executor executor;
    private BiometricPrompt biometricPrompt;
  
```

These are all the libraries that we are using in our Project.



Output



Code:

```
1 import androidx.appcompat.app.AppCompatActivity;
2 import androidx.biometric.BiometricPrompt;
3 import androidx.core.app.ActivityCompat;
4 import androidx.core.content.ContextCompat;
5 import android.os.Bundle;
6 import android.view.View;
7 import android.widget.Button;
8 import android.widget.TextView;
9
10 public class MainActivity extends AppCompatActivity {
11     private BiometricPrompt biometricPrompt;
12     private PromptInfo promptInfo;
13
14     @Override
15     protected void onCreate(Bundle savedInstanceState) {
16         super.onCreate(savedInstanceState);
17         setContentView(R.layout.activity_main);
18
19         btnAuth = findViewById(R.id.btnAuth);
20         tvAuthStatus = findViewById(R.id.tvAuthStatus);
21
22         executor = ContextCompat.getMainExecutor(this);
23
24         biometricPrompt = new BiometricPrompt(this, executor, new BiometricPrompt.AuthenticationCallback() {
25             @Override
26             public void onAuthenticationError(int errorCode, @NonNull CharSequence errString) {
27                 super.onAuthenticationError(errorCode, errString);
28                 // If any
29                 tvAuthStatus.setText("Error: " + errString);
30             }
31         });
32     }
33 }
```



```
MyApplication: app: src: main: java: com: example:.myapplication: MainActivity.java: activity_main.xml
```

```
44 @SuppressWarnings("NullableProblems")
45 @Override
46 public void onAuthenticationSucceeded(@NonNull BiometricPrompt.AuthenticationResult result) {
47     super.onAuthenticationSucceeded(result);
48     tvAuthStatus.setText("Authentication Successful");
49 }
50
51 @Override
52 public void onAuthenticationFailed() {
53     super.onAuthenticationFailed();
54     tvAuthStatus.setText("Authentication Failed");
55 }
56
57
58
59
60
61 //setup title , description on auth dialog
62 promptInfo = new PromptInfo.Builder()
63     .setTitle("Biometric authentication")
64     .setSubtitle("login using fingerprint and face")
65     .build();
```

Problems: Current File | Project Errors

Field can be converted to a local variable [1]

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28°C Clear

```
MyApplication: app: src: main: java: com: example:.myapplication: MainActivity.java: activity_main.xml
```

```
62 //setup title , description on auth dialog
63 promptInfo = new PromptInfo.Builder()
64     .setTitle("Biometric authentication")
65     .setSubtitle("login using fingerprint and face")
66     .setNegativeButtonText("cancel")
67     .build();
68
69
70
71 tvAuth.setOnClickListener(new View.OnClickListener() {
72     @Override
73     public void onClick(View v) {
74         biometricPrompt.authenticate(promptInfo);
75     }
76 });
```

Problems: Current File | Project Errors

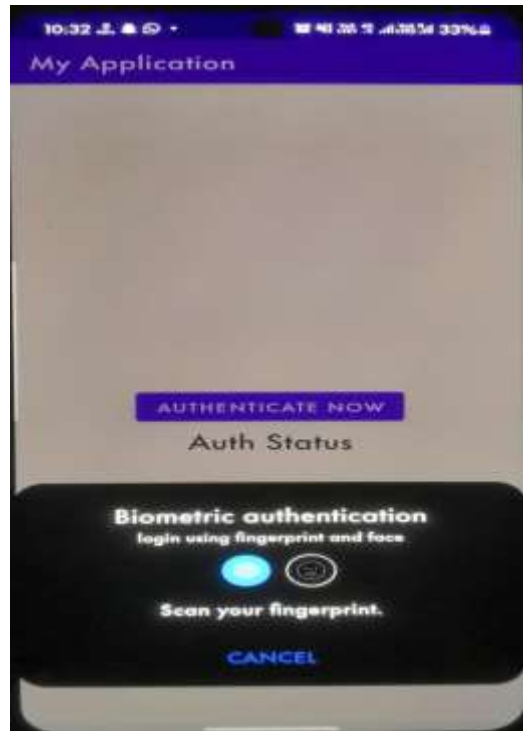
Field can be converted to a local variable [1]

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Output:



IMG: Home Page while Authenticating Face and Finger print



IMG: If fingerprint is not detected or wrong fingerprint entered shows this above error.



IMG: After Successful authentication of Finger Print are App moves to face detection. The Above Image shows if the face is not detected or wrong.



IMG: If Face is detected and authenticated successfully the above message is shown and app moves to the main UI.



IMG: After multi-modal successful authentication, the app moves to this UI.

2. CONCLUSION:

In this paper, we present a look into simple and efficient vision-based multimodal biometric system using heterogeneous biometric signals. By combining physical and behavioral biometric signals, we can achieve a high degree of reliability. Because the proposed system uses a single vision sensor, it can be easily implemented on commonly used smart devices such as smart TVs. More comprehensive study on developing efficient feature extraction and classification will be done for real world application of the proposal system.

Now a day's biometric systems are widely used to overcome the problems of traditional authentication.

Face recognition is an emerging technology that can provide many benefits. Face recognition can save resources and time, and even generate new income streams, for companies that implement it right.

Each fingerprint examination will result in one of the following conclusions: The fingerprint was made by (identified/individualized to) a known source (victim, suspect, etc.) The fingerprint was not made by (excluded to) a known source. The fingerprint cannot be identified or excluded to a known source (inconclusive). Now a day's biometric systems are widely used to overcome the problems of traditional authentication.

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