

# Voice Authentication App (Student Guide)

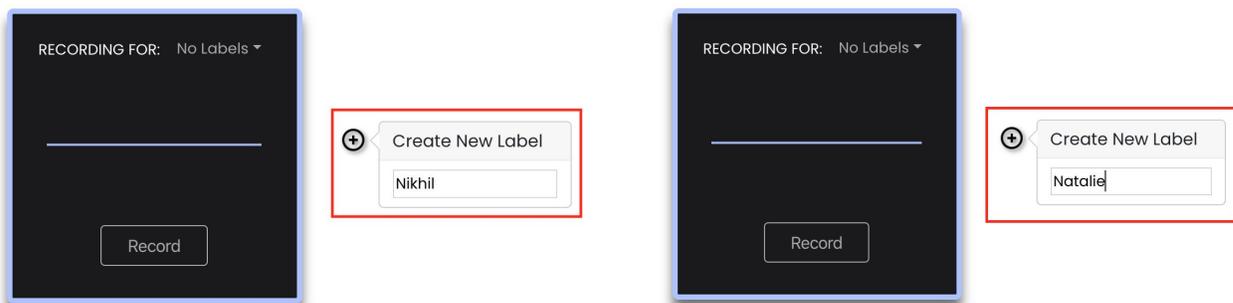
**NOTE: Not all mobile devices/operating systems currently have the required hardware/software to run the PAC extension used in this unit. We highly recommend testing beforehand with our test app to make sure it is compatible. Instructions for testing are included in [Appendix 1](#). If your device is not compatible, you can still play with the PAC website to learn how to train a model. You will not be able to try it in App Inventor.**

1. Navigate browser to <https://c1.appinventor.mit.edu/>

*You're going to train an audio classifier from scratch! First, you have to teach it what you want to classify. This is the "training" phase. You want to train two voices, so find a friend or family member to be your partner for this activity.*

Personal Audio Classifier **Train** Test

2. Click on the + icon to add labels for you and your partner's voice.



*In this example, there are two possible classifications for the model: Nikhil and Natalie.*

Your model is going to learn to distinguish between you and your partner saying the word “Hello.” You will record some voice clips for the model to train on.

3. Test your computer’s microphone and get a sense of how long each voice clip will be.

Practice by pressing record and saying “Hello” loudly and clearly (you may need to grant microphone access).

Make sure you only speak while the red recording bar is active.



As your microphone warms up, you may need to remove some bad recordings by pressing the blue “x” in the top right corner of each image.

4. Clear any practice recordings and record 5-10 good examples of you and your partner saying “Hello.”

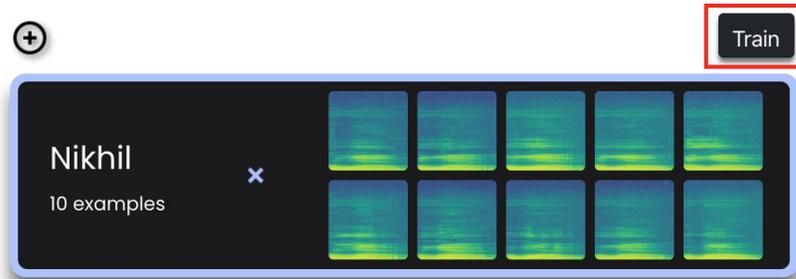
Click the “RECORDING FOR” button to change which person you are recording.



The image shows a user interface for voice recording. On the left is a recording panel with the text "RECORDING FOR: Natalie" and a "Record" button. On the right is a list of recorded examples. At the top right of the list is a "Train" button. The list contains two entries: "Nikhil" with "10 examples" and "Natalie" with "10 examples". Each entry has a grid of 10 spectrograms and a close button (x). A plus sign (+) is at the top left of the list area.

*Double check that your recorded examples look similar to the ones shown below (remember you can remove any odd-looking examples and record them again).*

5. Using your examples, you will now “train” the model. Press the “train” button, and then press “train model” using the default parameters.

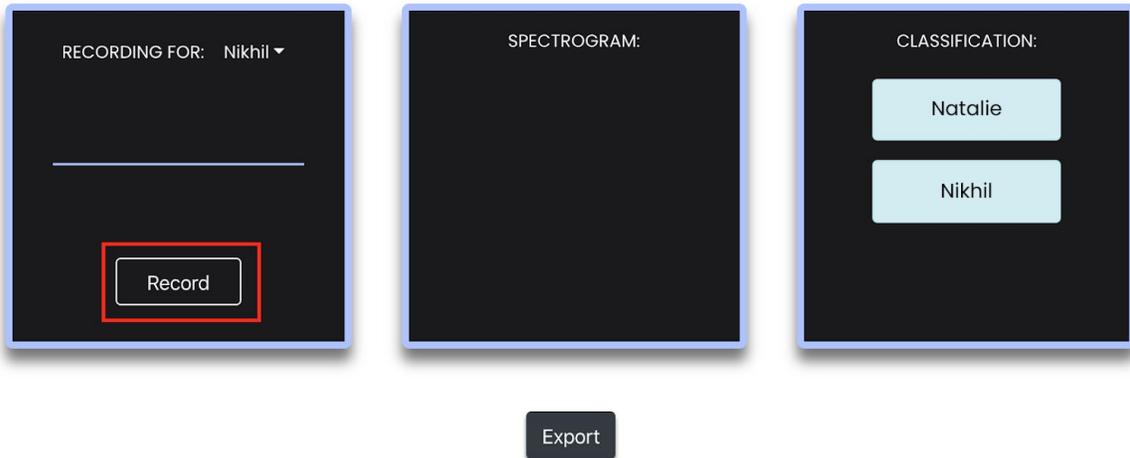


A screenshot of a "Customize Hyperparameters" dialog box. The dialog has a title bar with a close button (X). It contains four input fields for hyperparameters: "Learning Rate" (0.0001), "Optimizer" (Adam), "Epochs" (20), and "Training Data Fraction" (.4). At the bottom right, there are two buttons: a red "Close" button and a yellow "Train Model" button, which is highlighted with a red rectangular box.

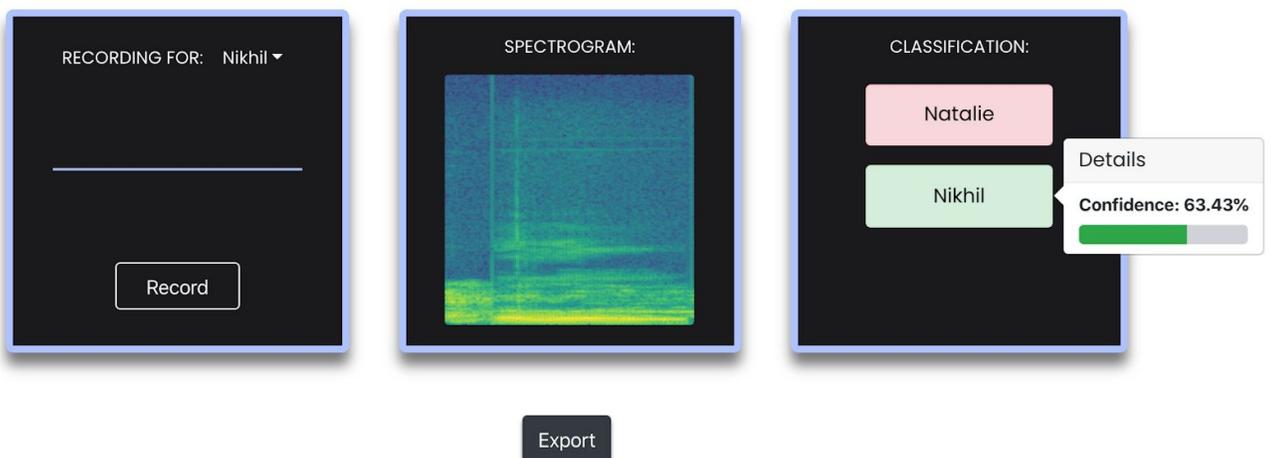
## 6. Now that your model is trained, it's time to test it!

*Press record to record a voice clip and see how the model classifies the clip!*

*(Don't worry about who the "RECORDING FOR" button is set to). Just see how the model performs for you and your partner's voices.*



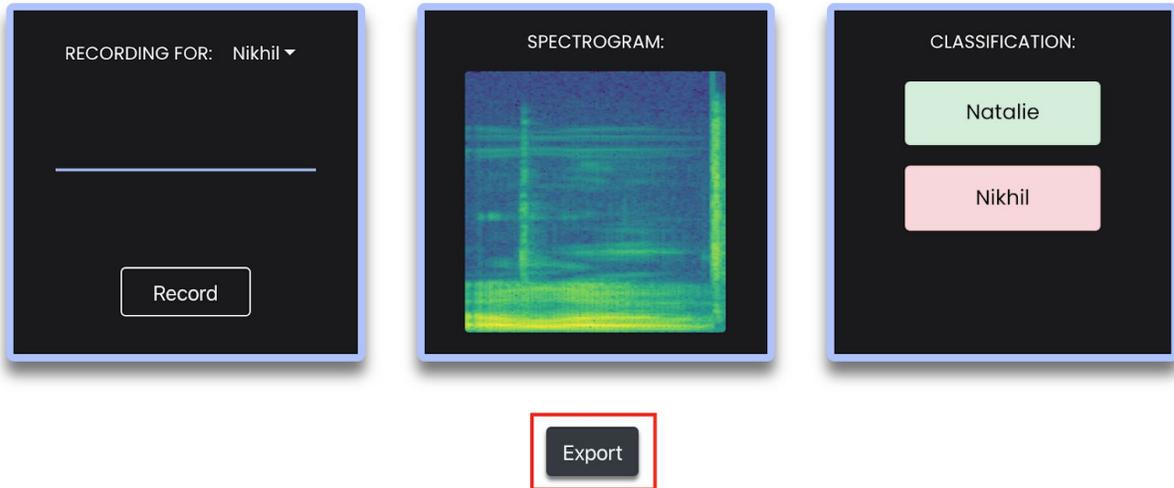
*Hover over each of the labels to see the model's confidence in its classification.*



*You can press the "train" button in the navbar to return to the training screen and record more examples (then retrain your updated model following step 4).*

Personal Audio Classifier **Train** Test

7. Once you're confident in your model, press the "Export" button to export your new model!

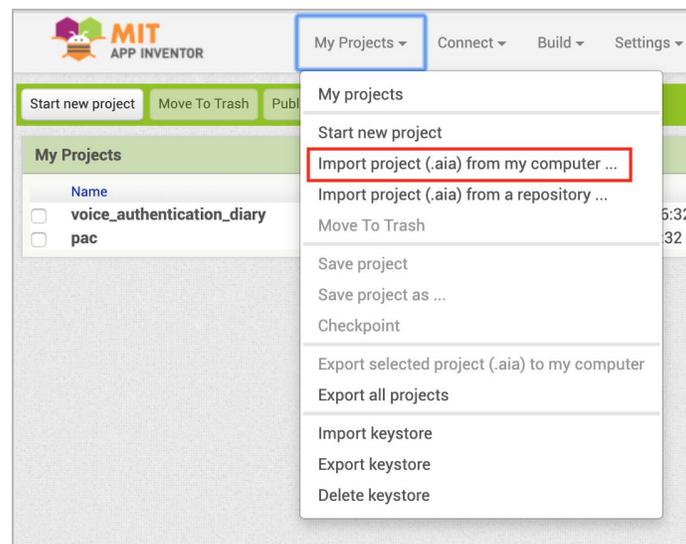


8. Now it's time to build your Voice Authentication App using this exported model!

Download the Voice Authentication Diary App Inventor project file (.aia) from this link:

[Voice authentication diary.aia](#)

Navigate to <http://ai2.appinventor.mit.edu/>, go to My Projects, and import the file you just downloaded.



This will be a Diary app authenticated by your voice saying “Hello”. Only you will be able to open your diary. Anyone else, in this case, your partner, won’t be able to get into your diary.

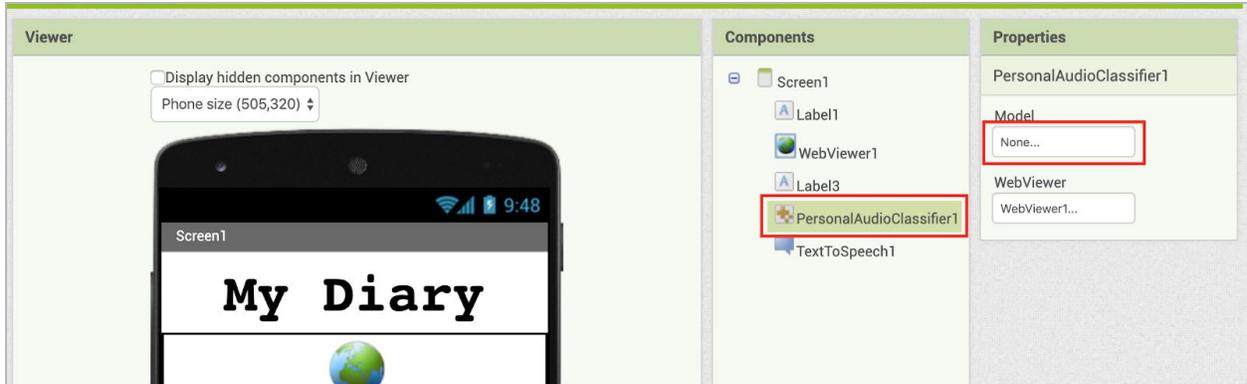
Note that your Diary app has two screens. You will focus on Screen1, where your voice will be authenticated. That will take you to Screen2, your diary.

*Open up the “voice\_authentication\_diary” app you just imported. In the Designer, drag in the following components and rename them and set their properties as follows.*

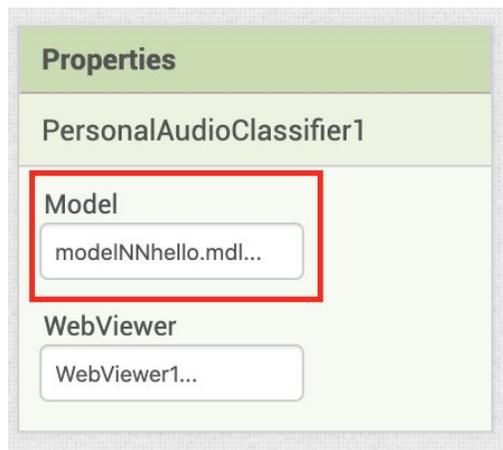
Component	Drawer	Name	Properties
Label	User Interface	DiaryLabel	Text: “My Diary” FontSize: 50 FontTypeface: monospace Width: Fill Parent TextAlignment: Center
WebView	User Interface	WebView1	
Label	User Interface	StatusLabel	Text: “Awaiting Classification” Width: Fill Parent TextAlignment: Center
PersonalAudio Classifier	Extensions	PersonalAudioClassifier1	WebView: WebView1
TextToSpeech	Media	TextToSpeech1	

## 9. Upload your model from the PAC website!

*Click on PersonalAudioClassifier1, and in the Properties window, click on Model where it says “None” and then upload your model.mdl file. Click OK.*

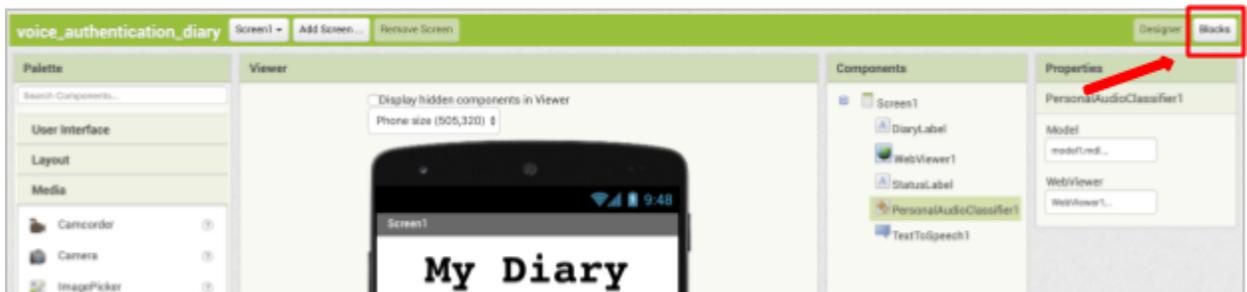


After uploading your model.mdl file, make sure it shows up in the “Model” box as shown below.



10. Now that your model is uploaded, edit the blocks to tell the diary who is allowed in!

Click on the Blocks button to navigate to the Blocks Editor.



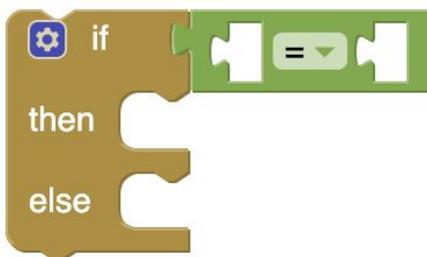
Click on *PersonalAudioClassifier1* in the **Blocks palette**, and drag out a *PersonalAudioClassifier1.GotClassification* block.



Set *StatusLabel.Text* to the result parameter in the event block.



Add an *if-then-else* block from the **Control Drawer**, and attach an *equals (=)* block from the **Logic drawer**.



The result returned is a list with the classifications from the model. The list will contain two sub-lists. Each sub-list will contain the label the classifier thinks is a match, followed by the confidence level. For example:

```
[ [Nikhil, 0.88527] , [Natalie, 0.34812] ]
```

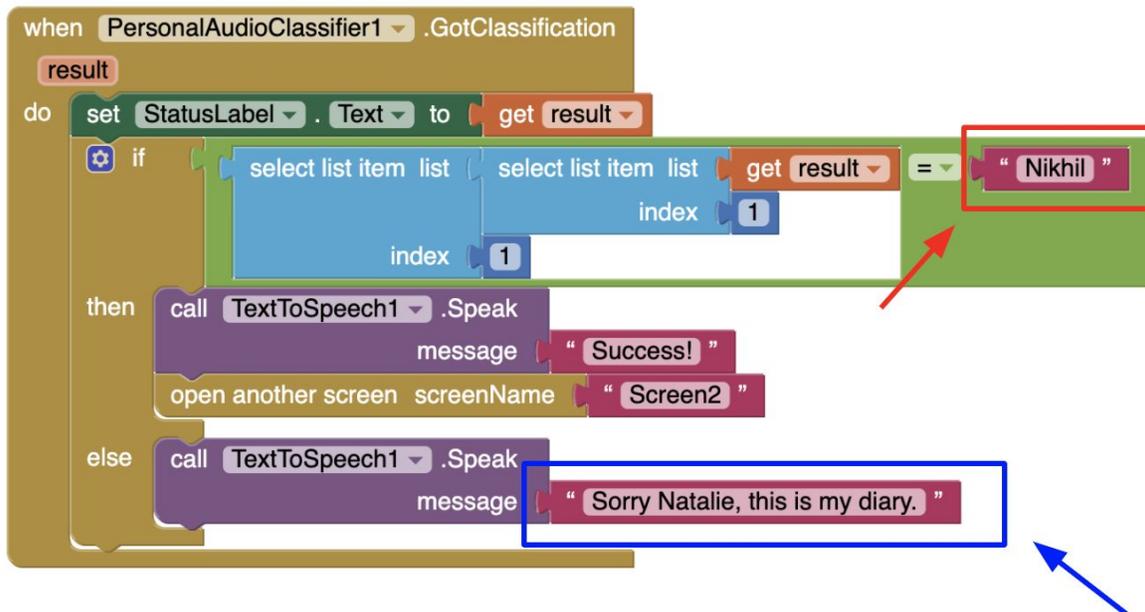
The classifier has 88% confidence that the voice matches Nikhil, and only 34% confidence the voice matches Natalie. You want to pull out the first item in the first sublist, in this case “Nikhil” and test if that is the person whose diary this is.

To do this, use two *select list item* blocks from the **Lists drawer**. First, get the first item (index) from *get result* (your main list). That then becomes your list to extract again the first item (index), which in this example is “Nikhil”.

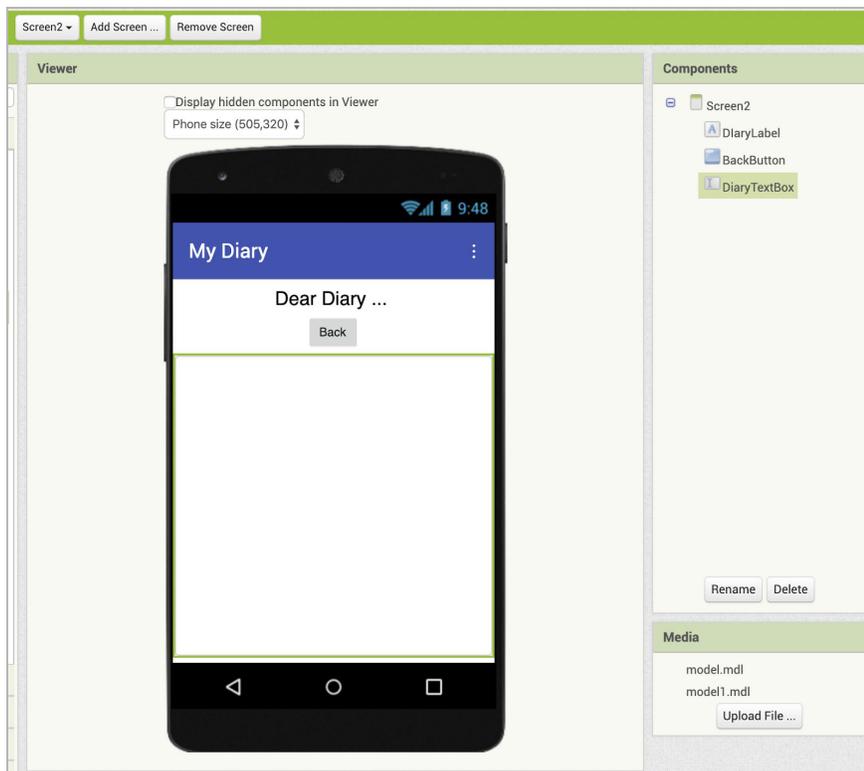
If there is a match, you want to say “Success!” using the *TextToSpeech1* component, and then open *Screen2*.

If there is not a match, you can assume your partner (or someone else) tried to open your Diary app, so add a message using **TextToSpeech** telling them they are shut out.

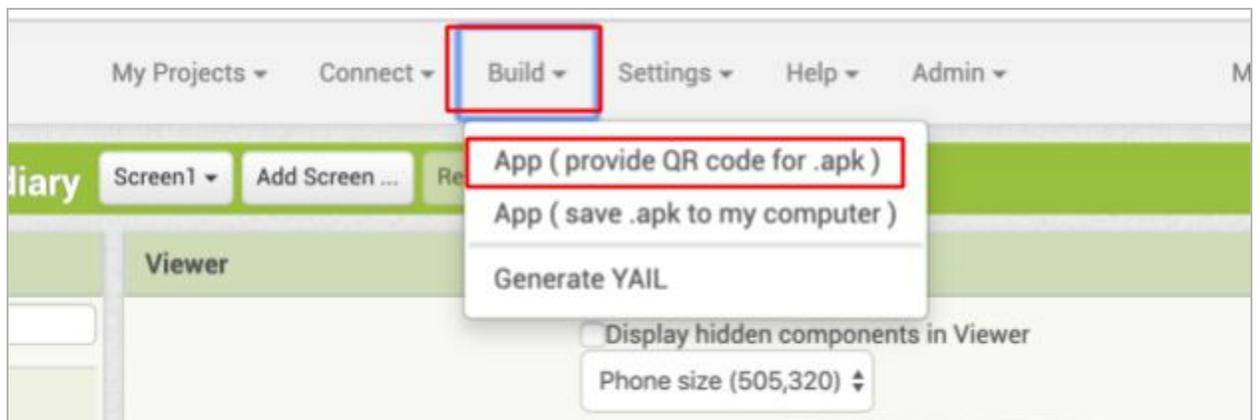
Your blocks should look something like the ones below. The **red box** should contain your name (using the label you used in `c1.appinventor.mit.edu`). The **blue box** should contain a phrase that the app will speak out loud if it doesn't think the voice is you!



11. And you're done! Take a quick look at Screen2 provided in the template. It simply allows you to type whatever you want in your diary. There is a back button to return to Screen1. The task is left to you to build out the diary aspect of this app. One recommendation is to use TinyDB and store your diary entries on your device so you can save and read your previous diary entries.



12. The PersonalAudioClassifier extension does not currently work with the MIT AI2 Companion, so you must build the application using the **Build** menu in App Inventor. Choose the “*provide QR code for .apk*” option, and then use a QR Code Reader app, or the MIT AI2 Companion on your device to scan the QR code. Follow the instructions to install the app on your phone or tablet.



13. Test it out! You should be able to say “Hello” and proceed to Screen2. Your partner, however, should be blocked from seeing your diary.

### *Tips to Test and Debug*

On Screen1, **StatusLabel** displays the result returned from the Classifier. If your app does not work as expected, check what the Classifier is returning. Check that your name appears first in the returned result list. If not, you might have to go back and train your model again!

Another possibility is that the confidence level is too low. Can you figure out how to add code to test that the confidence level is greater than 80%? Remember, the second value in your sublist is the confidence level.

# Appendix 1

## Testing Hardware

In order to check beforehand if the Diary app will work on your device, we've provided a project to test it out. Start by downloading this Test\_PAC.apk ([link](#)) onto your computer. Install the app on your device. Run the app. You should see a "Waiting..." label at the top of the screen in the app. After at most a minute, the label display should change to "Ready and working!". If the label does not change, it means your device will not work with the PAC extension.