Recognition, Localization, and Notification

An AI-Based Discovery with Sound Waves

4 Nov. 2022
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DS323 AI in Design, Fall 2022
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Earlier Discoveries

Staring from disaster rescue needs implemented by smart robots moving around

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Staring from disaster rescue needs implemented by smart robots moving around

Overcome Complicity & Narrow Situations

Detect Signal of Life Existence

Keep Terrain Data for Further Uses

Avoid Rescuers Casualties

Multi-Dimensional Environment Monitor

Transfer Goods in Case of Emergency

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Staring from disaster rescue needs implemented by smart robots moving around

Keep Terrain Data for Further Uses – LiDAR (Light Detection and Ranging) Mapping

https://mloizmwf879z.i.optimole.com/cb:7B07~1808a/w:800/h:450/q:mauto/https://geoslam.com/wp-content/uploads/2021/07/LiDAR-scanner-buildings.gif

Earlier Discoveries

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Earlier Discoveries

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Detect Signal of Life Existence – Radar, Infrared, etc.

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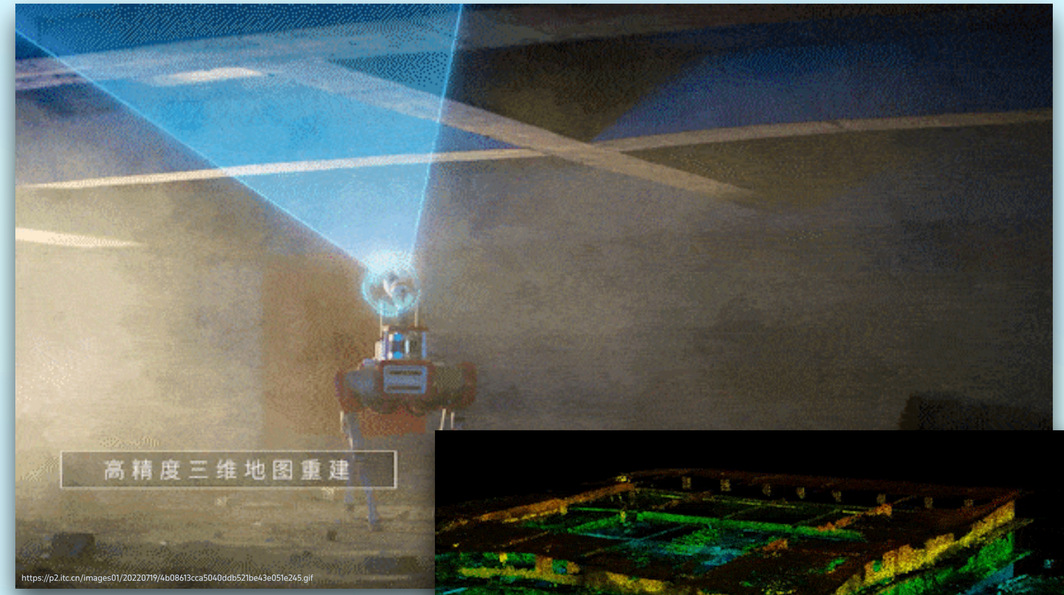
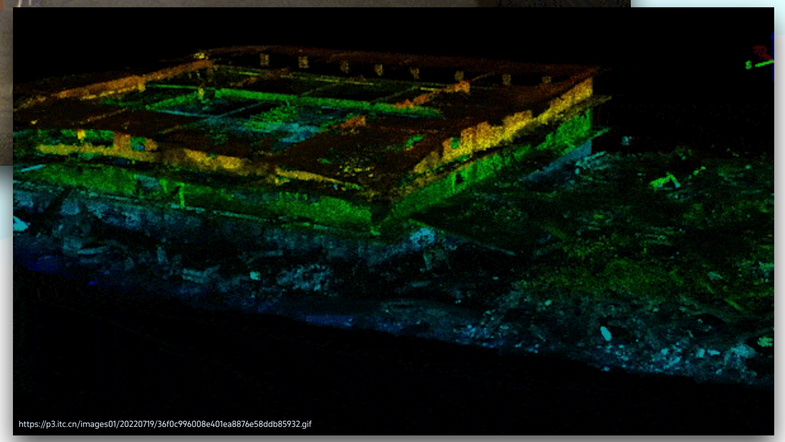
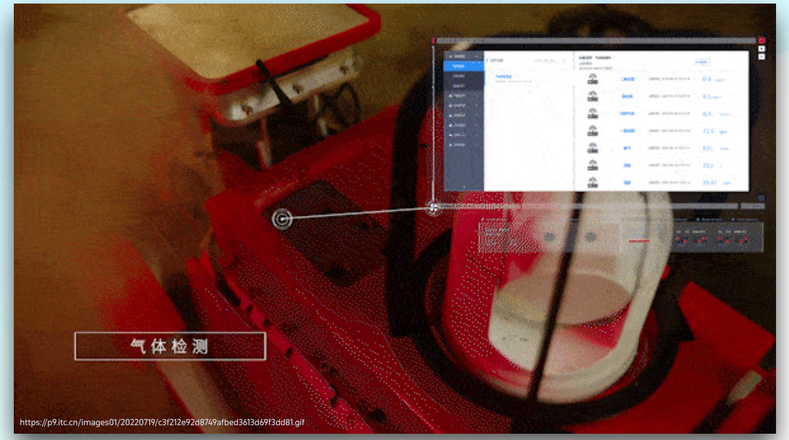




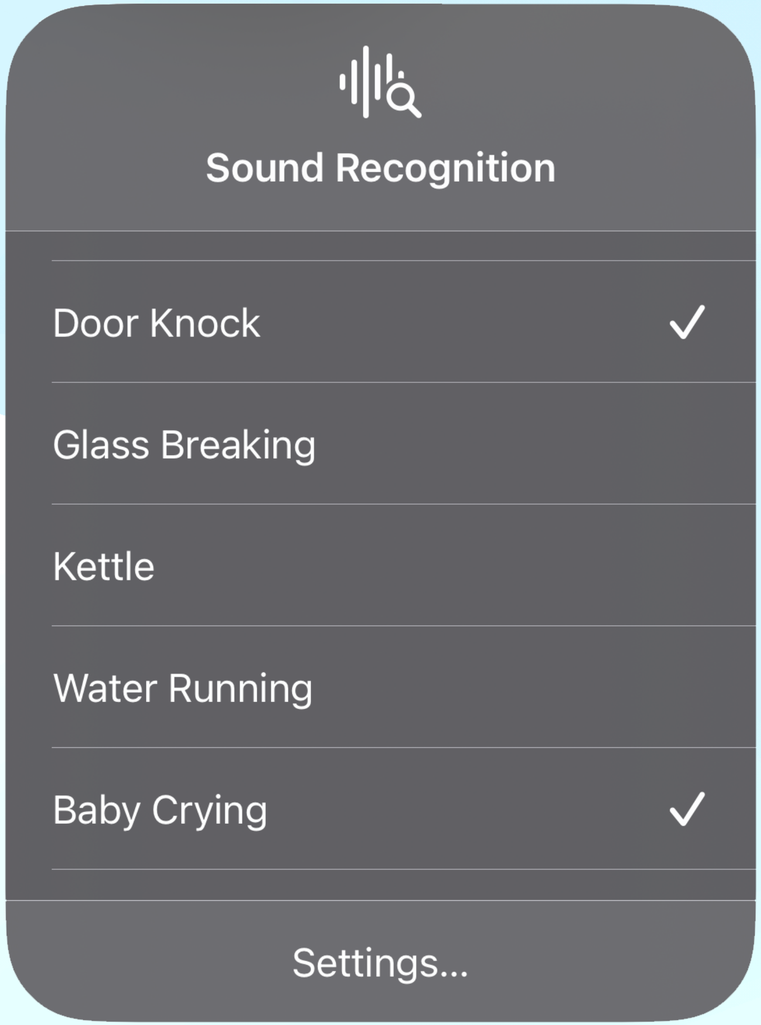


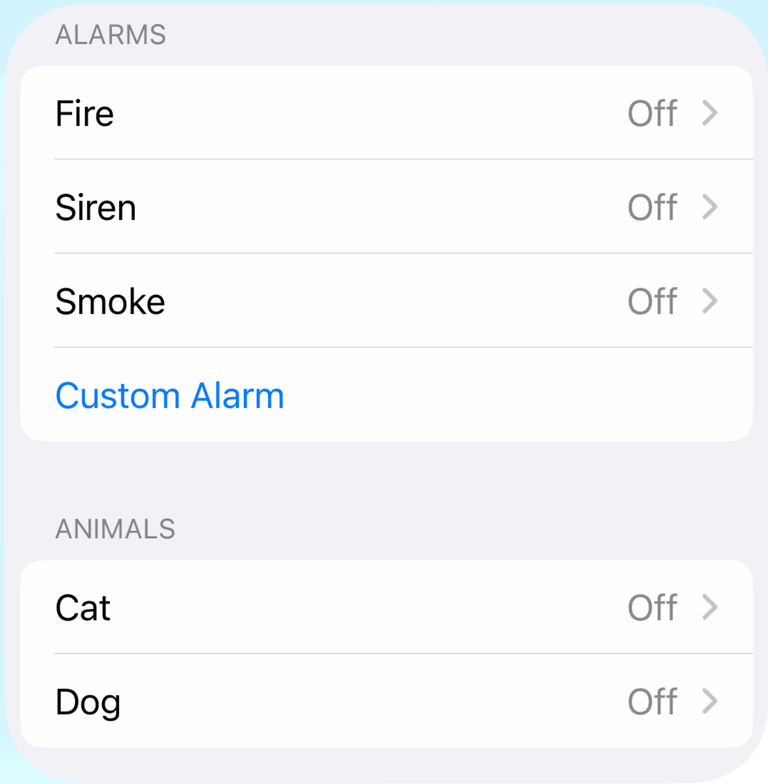
Sound Recognition?

Inspired by Danish children sleeping outside by themselves in backyards, parks, and even restaurants

A Pre-Trained Model

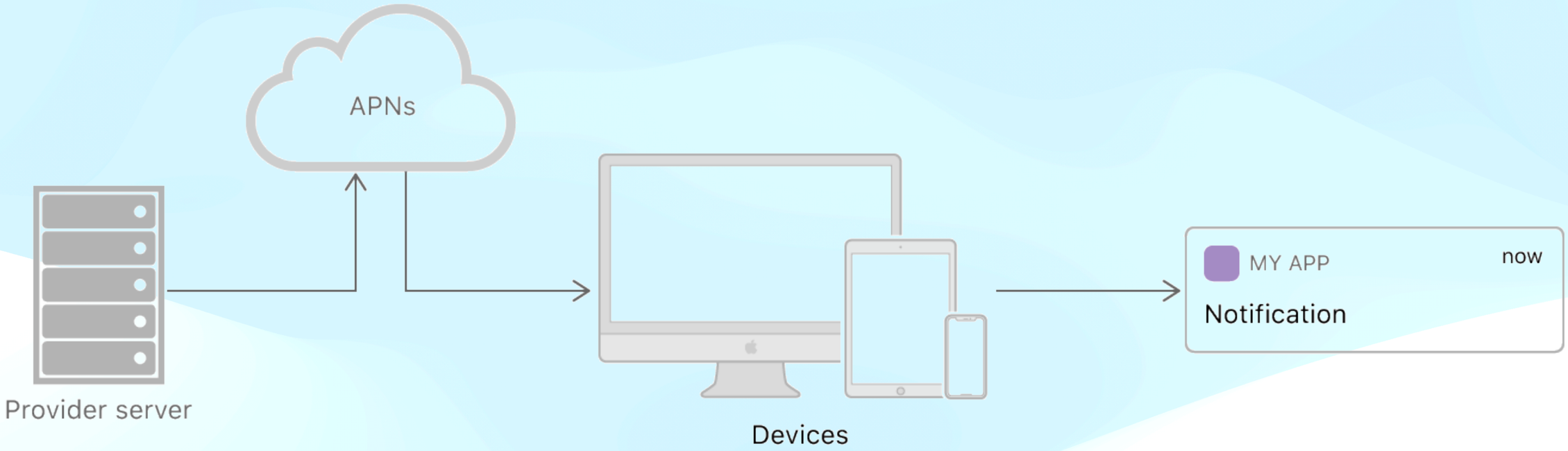
As an accessibility feature integrated to mobile devices by Apple





To Notify...

Smart notification service running through OSPNS with a little delay, or from a physical signal connection instantly



To Notify...

Smart notification service running through OSPNS with a little delay, or from a physical signal connection instantly

Sound identification

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to th
e extent
permitted by applicable law.
Last login: Thu Nov  3 10:10:08 2022 from 20.24.204.1
root@cloud:~# docker run -dt --name bark1 -p 8080:808
 `pwd`/bark-data:/data finab/bark-server
14ba8074586b025e1cc67057b85ce0378387a1e7fa985869a37db
1013793
root@cloud:~#
```

parallels@kali: ~

File Actions Edit View Help

```
┌──(parallels㉿kali)-[~]
└─$ curl "hk.chengwei.design:8080/YzJijPSEP9QEP
bsrZJS7zc/%22Stroller%22%20detects%20a%20cry/De
vice%20%22Stroller%22%20has%20detected%20a%20cr
y.%20You%20may%20take%20further%20actions.?leve
l=timeSensitive"
{"code":200,"message":"success","timestamp":166
7444552}

┌──(parallels㉿kali)-[~]
└─$
```

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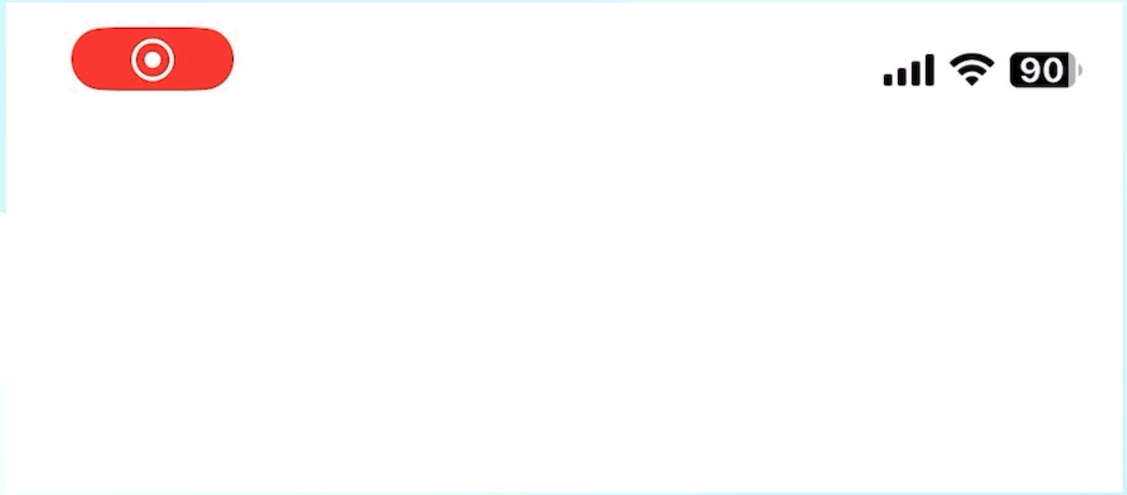
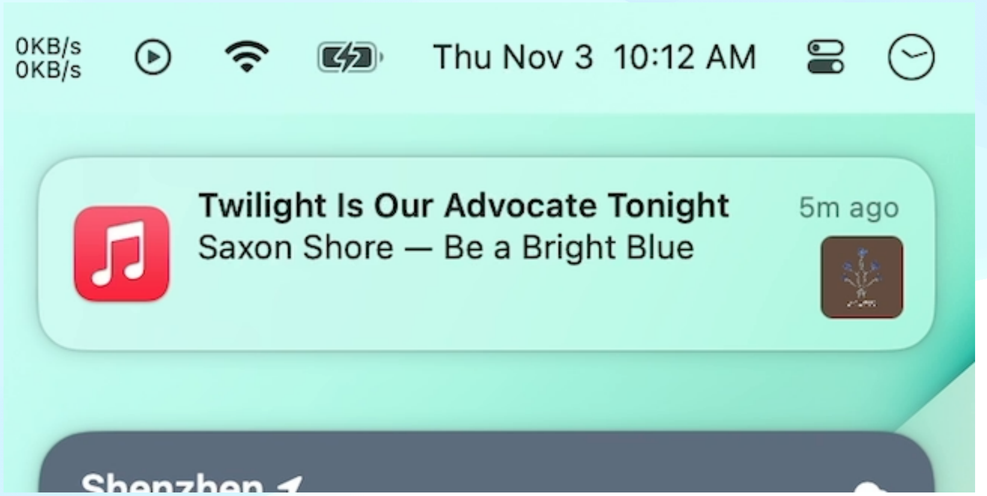




Sound Localization?

To help deaf people be aware of potential danger alarmed in the form of sound

To Localize...

To find the source - where the sound comes from

sensors

MDPI

Article

Sound Source Localization Using a Convolutional Neural Network and Regression Model

Tan-Hsu Tan, Yu-Tang Lin, Yang-Lang Chang and Mohammad Alkhaleefah *

nature human behaviour

ARTICLES

https://doi.org/10.1038/s41562-021-01244-z

Check for updates

Deep neural network models of sound localization reveal how perception is adapted to real-world environments

Andrew Francl [1,2,3] ✉ and Josh H. McDermott [1,2,3,4] ✉

Mammals localize sounds using information from their two ears. Localization in real-world conditions is challenging, as echoes provide erroneous information and noises mask parts of target sounds. To better understand real-world localization, we equipped a deep neural network with human ears and trained it to localize sounds in a virtual environment. The resulting model localized accurately in realistic conditions with noise and reverberation. In simulated experiments, the model exhibited many features of human spatial hearing: sensitivity to monaural spectral cues and interaural time and level differences, integration across frequency, biases for sound onsets and limits on localization of concurrent sources. But when trained in unnatural environments without reverberation, noise or natural sounds, these performance characteristics deviated from those of humans. The results show how biological hearing is adapted to the challenges of real-world environments and illustrate how artificial neural networks can reveal the real-world constraints that shape perception.

DE GRUYTER J. Intell. Syst. 2021; 30:209–223

Research Article

Zhuhe Wang, Nan Li*, Tao Wu, Haoxuan Zhang, and Tao Feng

Simulation of Human Ear Recognition Sound Direction Based on Convolutional Neural Network

https://doi.org/10.1515/jisys-2019-0250
Received Nov 22, 2019; accepted Apr 11, 2020

Abstract: In recent years, more and more people are applying Convolutional Neural Networks to the study of sound signals. The main reason is the translational invariance of convolution in time and space. Thereby the diversity of the sound signal can be overcome. However, in terms of sound direction recognition, there are also problems such as a microphone matrix being too large, and feature selection. This paper proposes a sound direction recognition using a simulated human head with microphones at both ears. Theoretically, the two microphones cannot distinguish the front and rear directions. However, we use the original data of the two channels as the input of the convolutional neural network, and the resolution effect can reach more than 0.9. For comparison, we also chose the delay feature (GCC) for sound direction recognition. Finally, we also conducted experiments that used probability distributions to identify more directions.

Keywords: Convolutional Neural Network, simulated human head, dual-channel raw data, GCC, probability distributions

To Localize...

To find the source - where the sound comes from

UrbanSound8K

8732 labeled sound excerpts

Last Updated: 3 years ago (Version 1)

About this Dataset

This dataset contains 8732 labeled sound excerpts (<=4s) of urban sounds from 10 classes: `air_conditioner`, `car_horn`, `children_playing`, `dog_bark`, `drilling`, `enginge_idling`, `gun_shot`, `jackhammer`, `siren`, and `street_music`. The classes are drawn from the urban sound taxonomy. For a detailed description of the dataset and how it was compiled please refer to our paper.

All excerpts are taken from field recordings uploaded to www.freesound.org. The files are pre-sorted into ten folds (folders named fold1-fold10) to help in the reproduction of and comparison with the automatic classification results reported in the article above.

In addition to the sound excerpts, a CSV file containing metadata about each excerpt is also provided.

AUDIO FILES INCLUDED

8732 audio files of urban sounds (see description above) in WAV format. The sampling rate, bit depth, and number of channels are the same as those of the original file uploaded to Freesound (and hence may vary from file to file).

META-DATA FILES INCLUDED

```
UrbanSound8k.csv
```

Input (7.09 GB)

Data Sources

UrbanSound8K

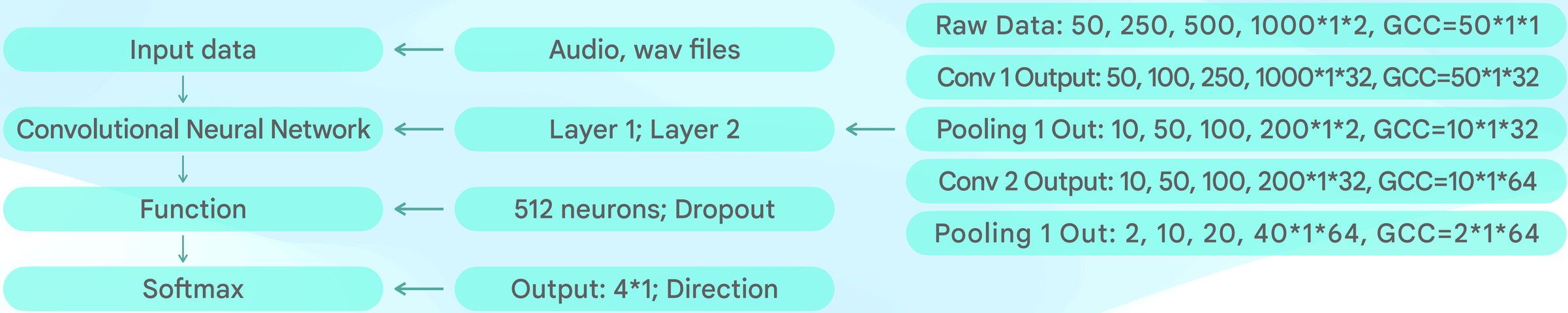
Output

UrbanSound8kResults.csv

https://www.kaggle.com/code/prabhavsingh/urbansound8k-classification/data

To Localize...

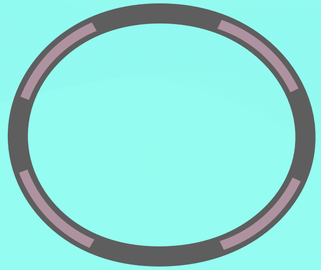
To find the source - where the sound comes from



To Localize...

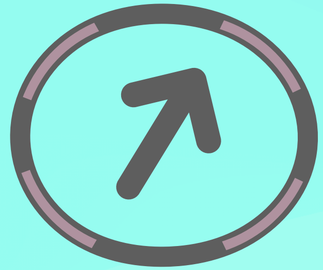
To find the source - where the sound comes from

Sound direction recognition
& Haptic feedback



Quad-microphone system

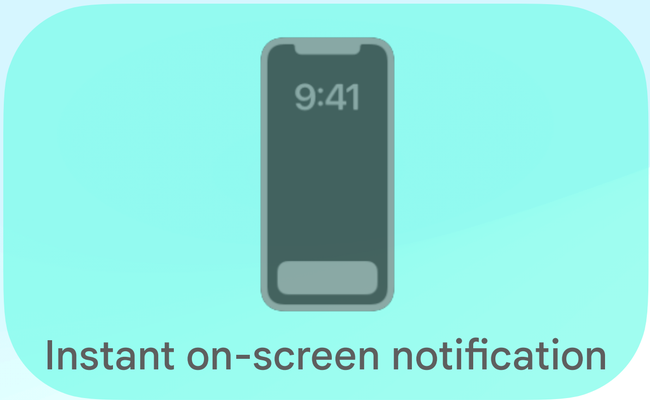
On-device intelligence



Sound direction

To Transform...

To turn the "unreachable" sound to other senses



"AcouSource ViBelt"

To help deaf people be aware of potential danger alarmed in the form of sound

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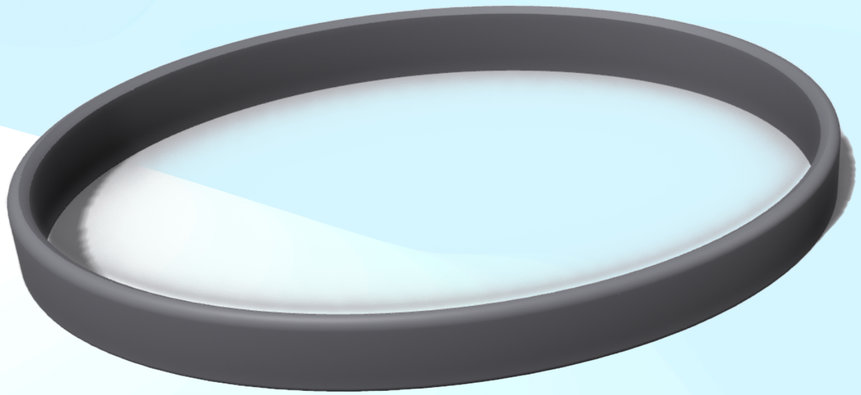

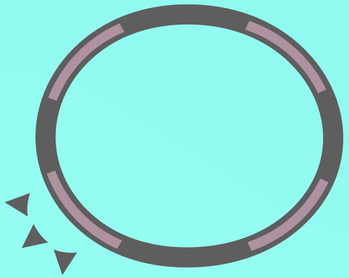

Instant haptic feedback

Instant on-screen notification

Notified!

"AcouSource ViBelt"

To help deaf people be aware of potential danger alarmed in the form of sound

"AcouSource Omnisten"

Distinguish any sound, and get you notified, at an affordable price

Furthermore

Thanks for Listening!

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