Inclusive Design for Deaf and Hard of Hearing Using AI in a Scalable Way

Swetha Machanavajhala
Software Engineer 2

Xiaoyong Zhu
Program Manager 2

Microsoft

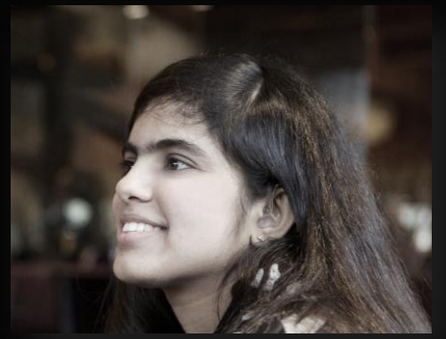
CSUN Conference 2018, San Diego

True life threatening incident

Carbon monoxide detector was beeping for a WEEK at Swetha's house.

Since she is hard of hearing, she was unaware until a neighbor informed her.

Swetha Machanavajhala



World population

7,444,594,497

People with disabilities

1,000,000,0000

Deaf or hard of hearing

360,000,000

DISABILITY

≠

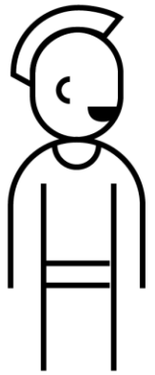
PERSONAL HEALTH CONDITION

DISABILITY

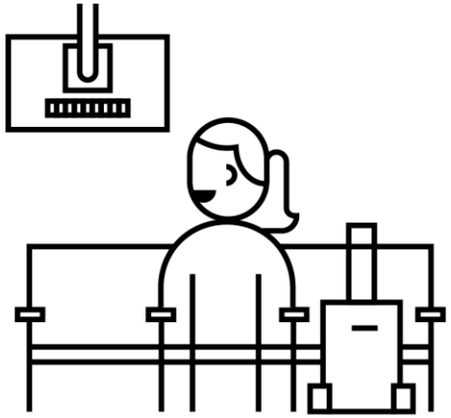
=

MISMATCHED HUMAN INTERACTIONS

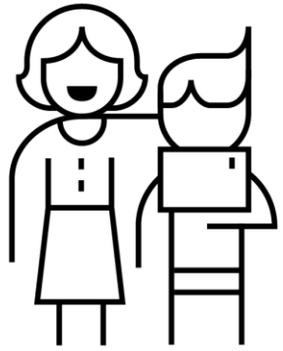
Inclusive Design



Hard of hearing



Reading in an airport



Teaching a child to read

More people benefit from closed captioning

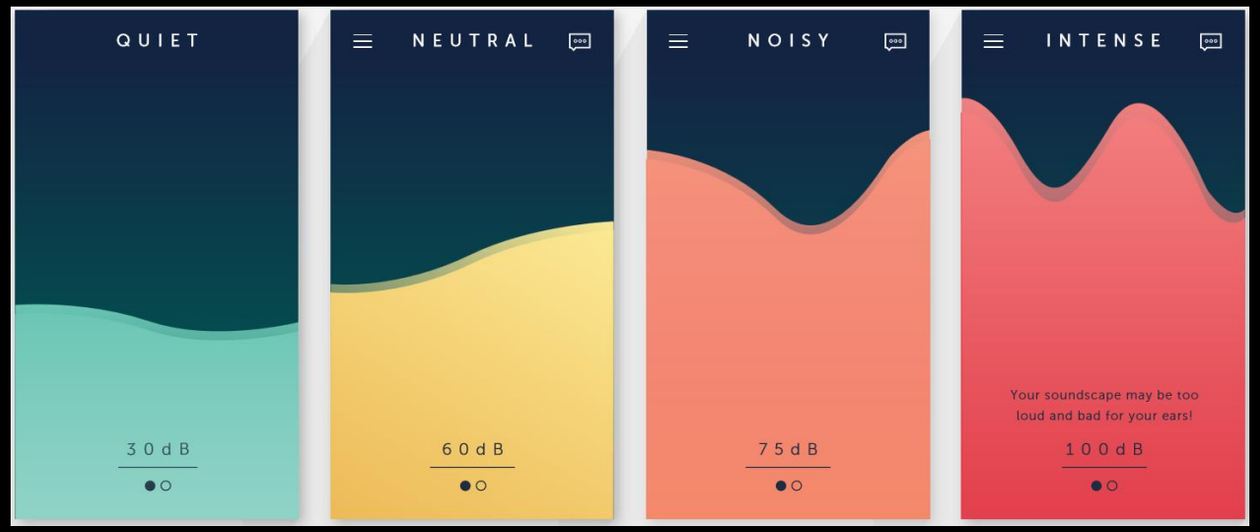
WHY MUST SOUND ONLY BE HEARD?

Your soundscape may be too loud and bad for your ears!
100dB
NOISY
75dB
60dB
QUIET
NEUTRAL

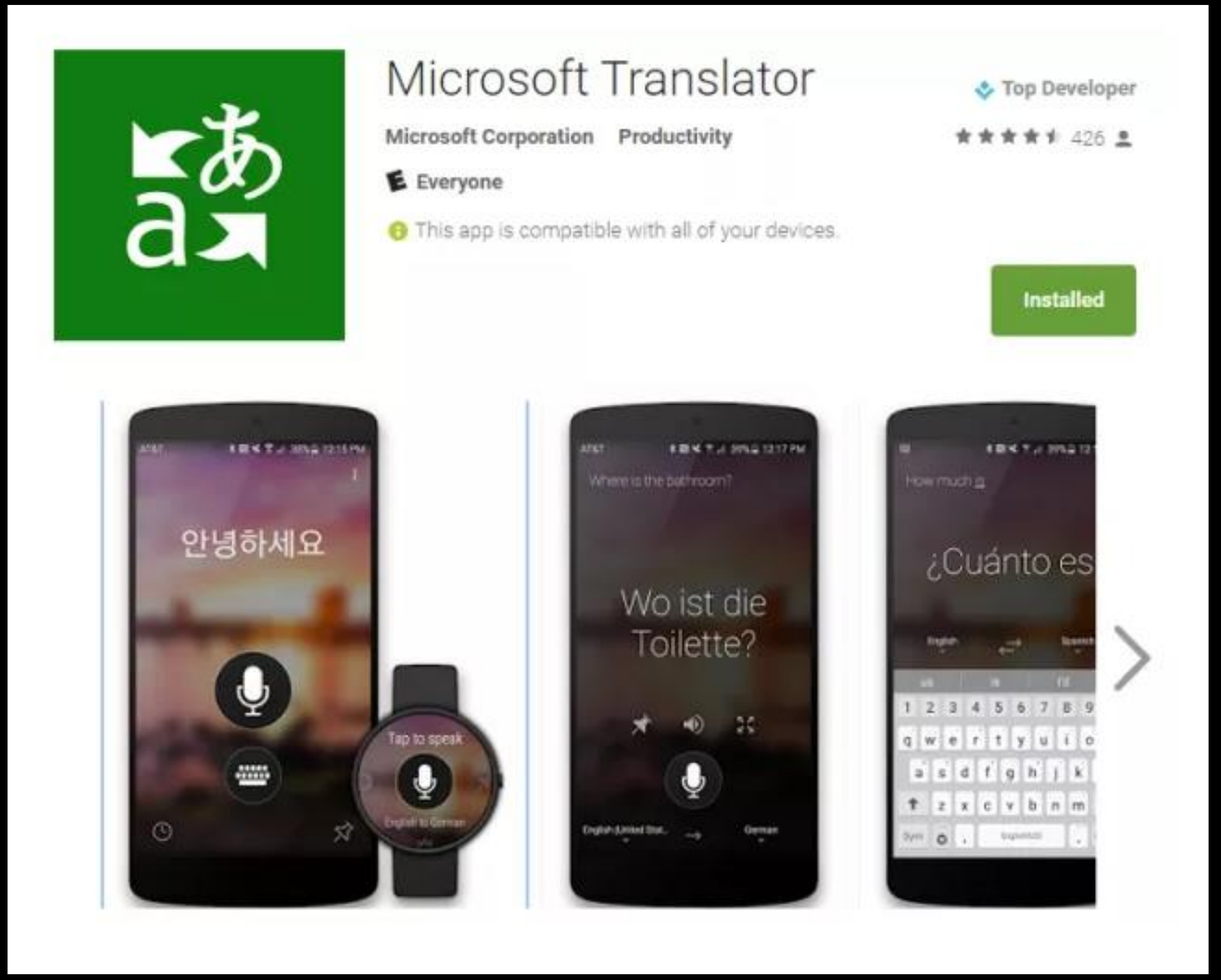
Hearing AI

INTENSE
Your soundscape may be too loud and bad for your ears!
100dB

QUIET
30dB

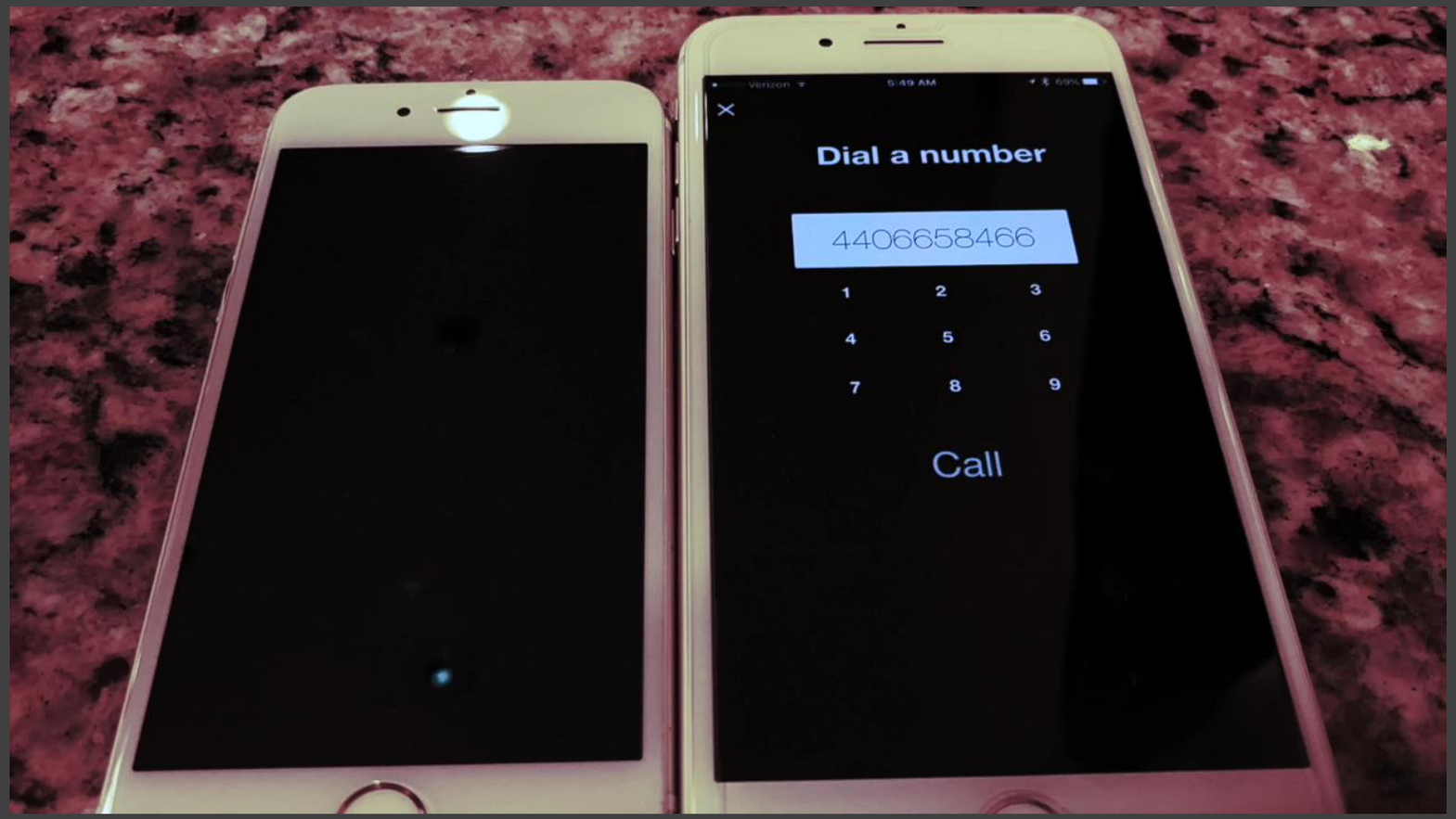


Visualizing sounds



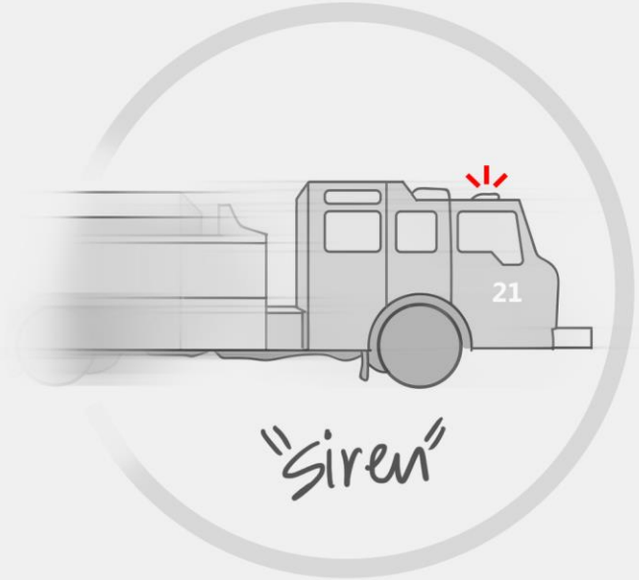
Transcribe and Translate spoken conversations

Capturing loudness real-time

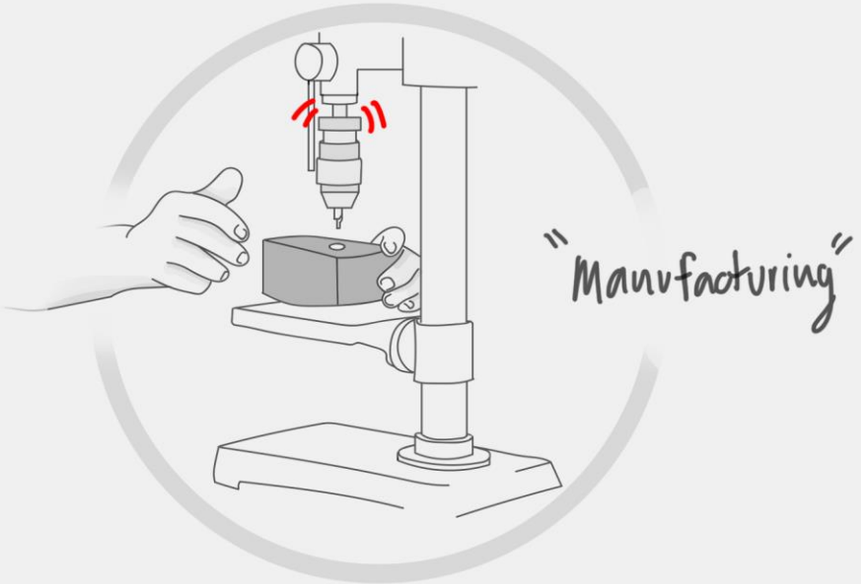


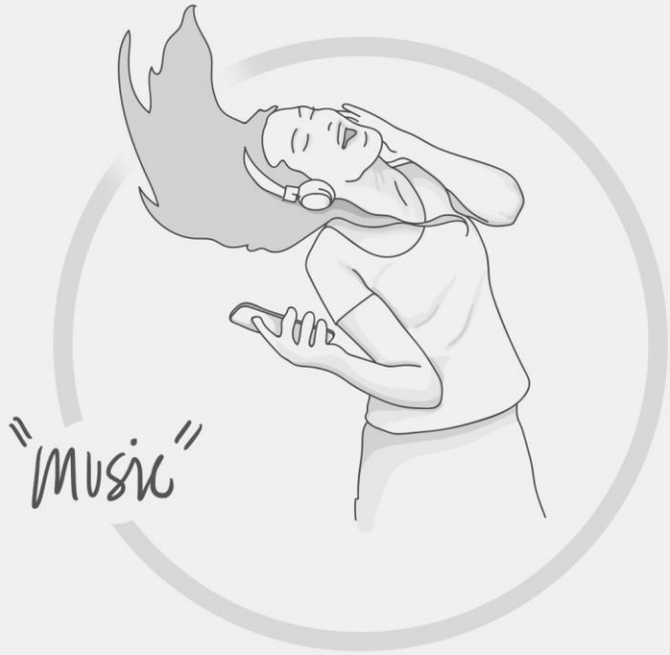
Transcribing phone calls real-time

Hearing AI can do more…


21
"Siren"

"coffee shop"


"Manufacturing"


"Music"

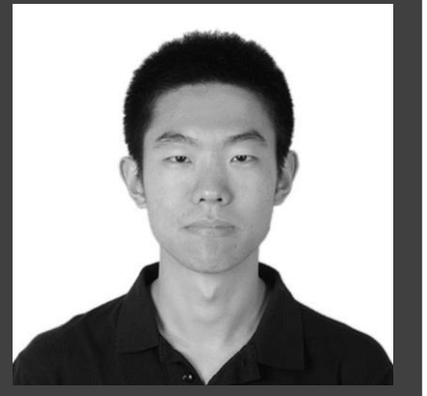
Hey Swetha,
I hear a window glass shatter!
ADCAST
HOME
HISTORY

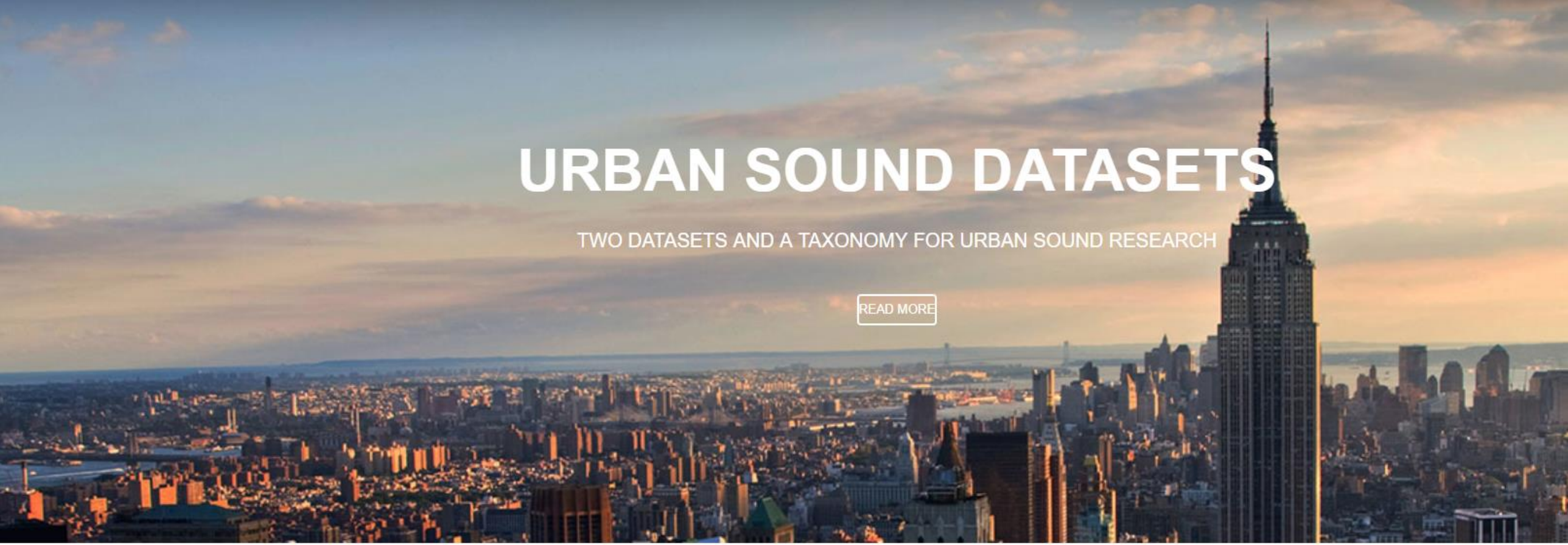
"broken glass!"

Can we scale up?

Deep Learning on audio in Azure

Xiaoyong Zhu




URBAN SOUND DATASETS
TWO DATASETS AND A TAXONOMY FOR URBAN SOUND RESEARCH
READ MORE

Is everywhere you are…!

CNN on audio? How?

Trick

Convert 1D Audio to 2D image

2D image = mel-spectrogram

Input to CNN = mel-spectogram

Figure 1: Waveplot

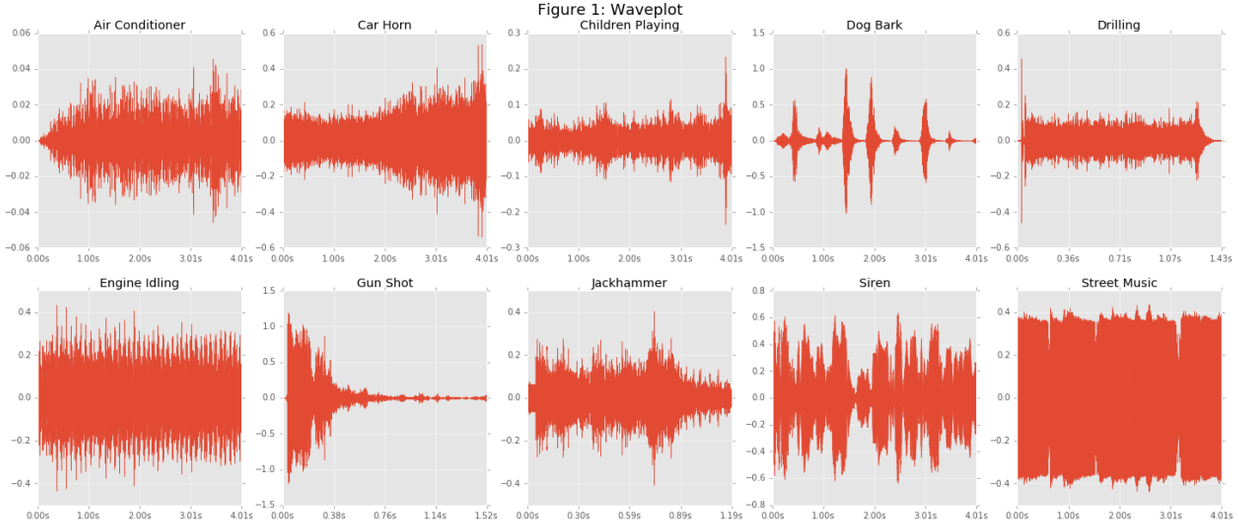
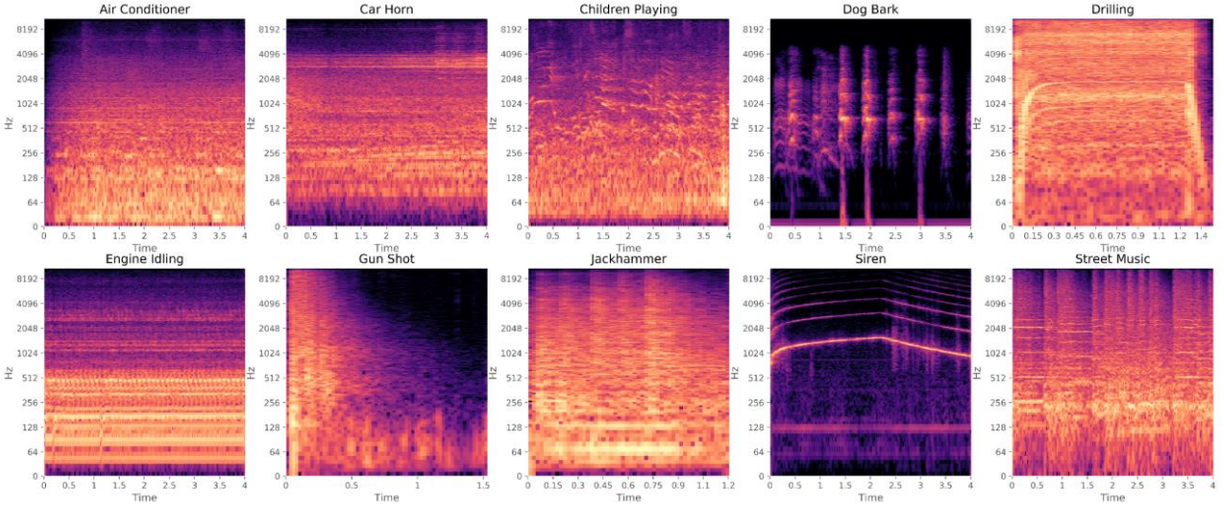


Figure 3: Log power spectrogram

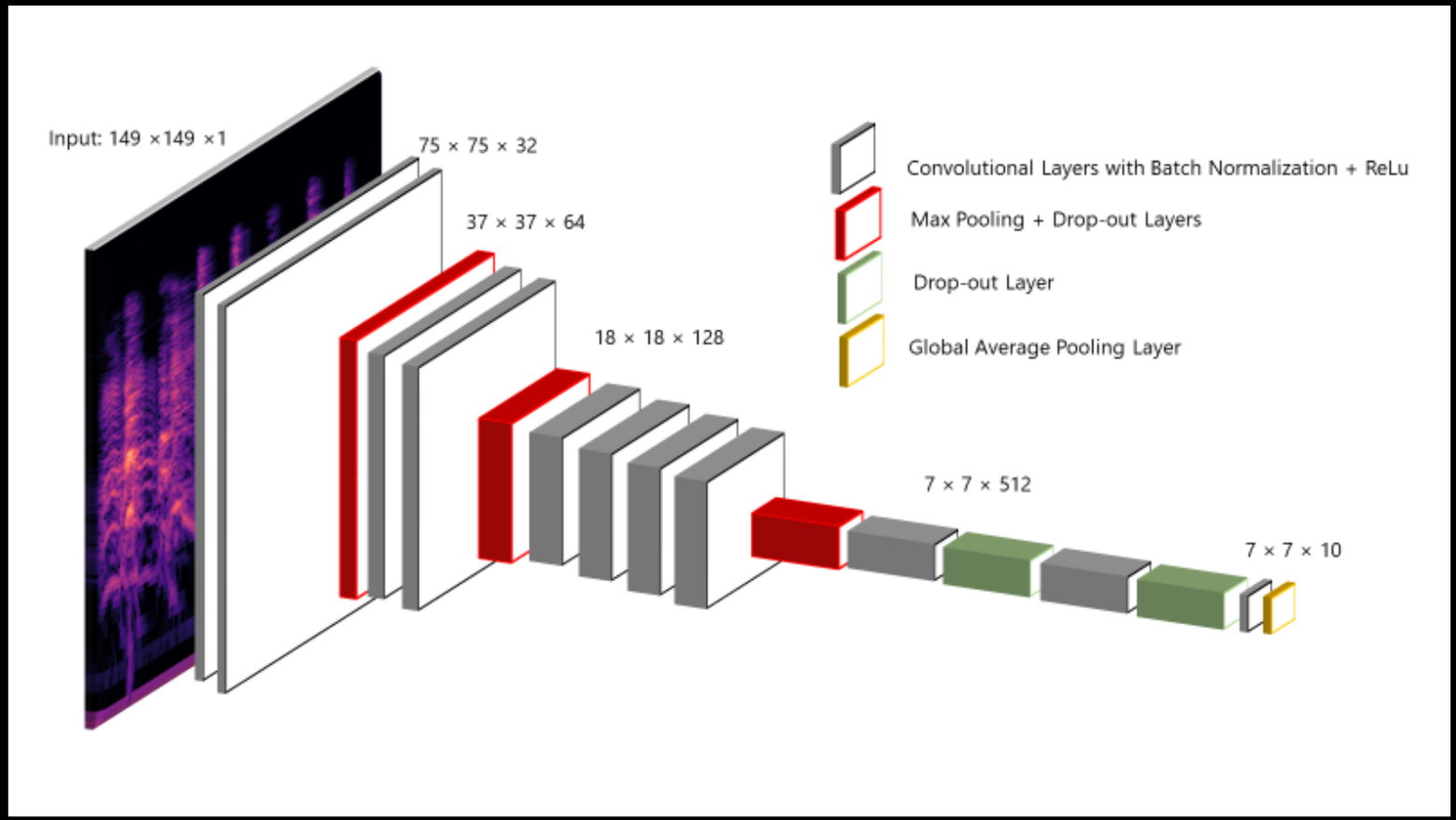


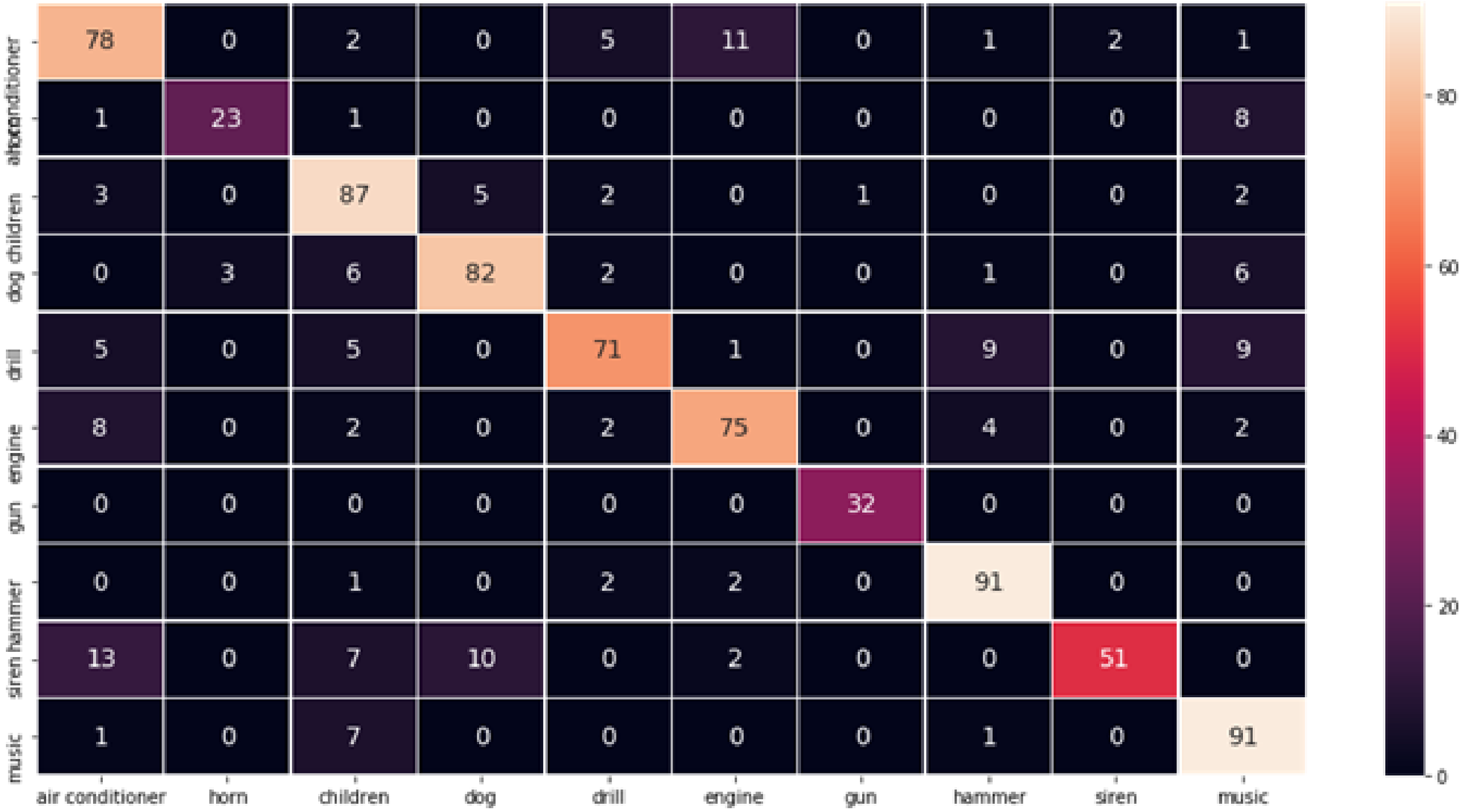
Convert audio amplitude to what human ears hear

AI Algorithm

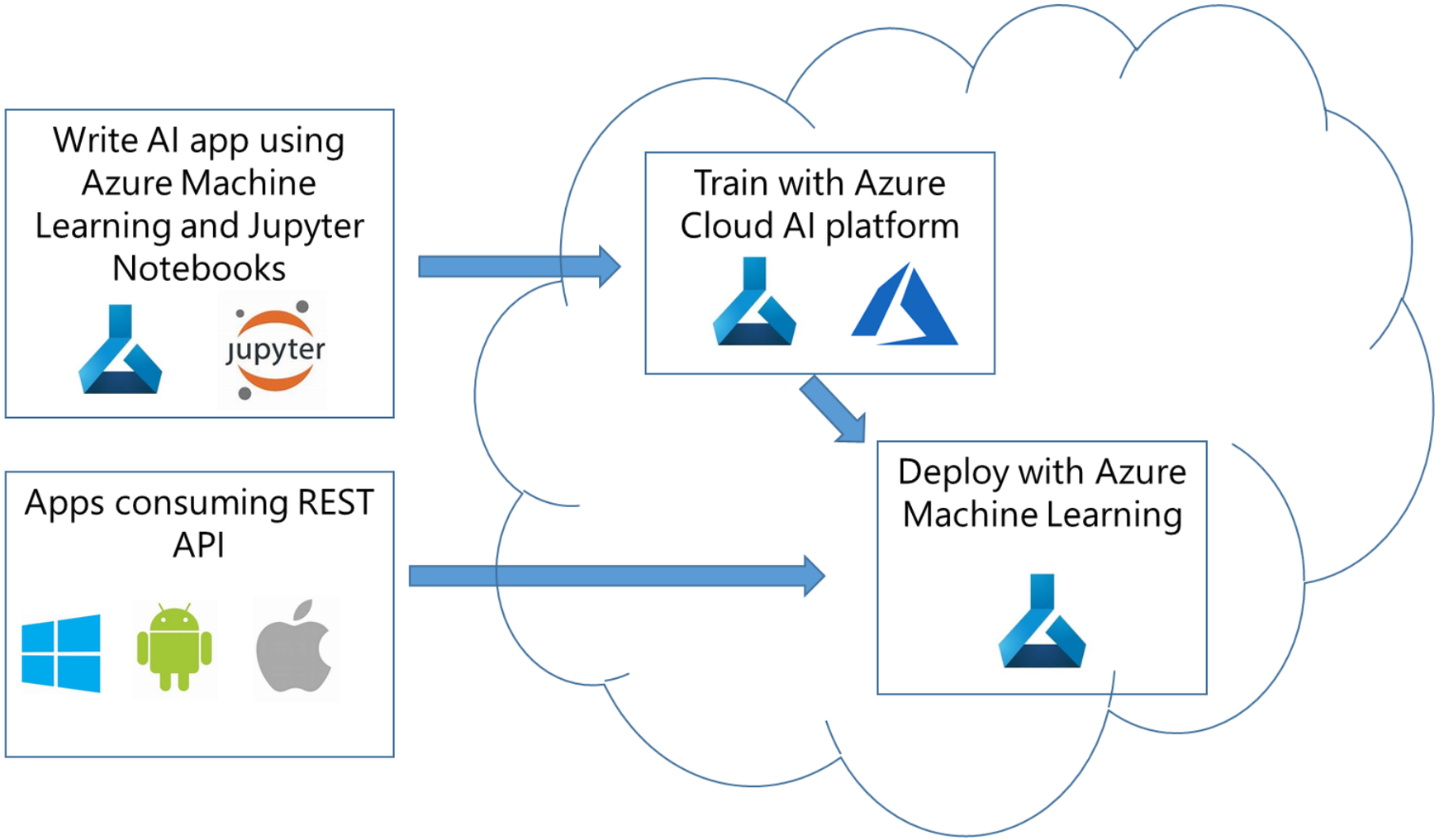
11 Layer CNN

Batch normalization layers

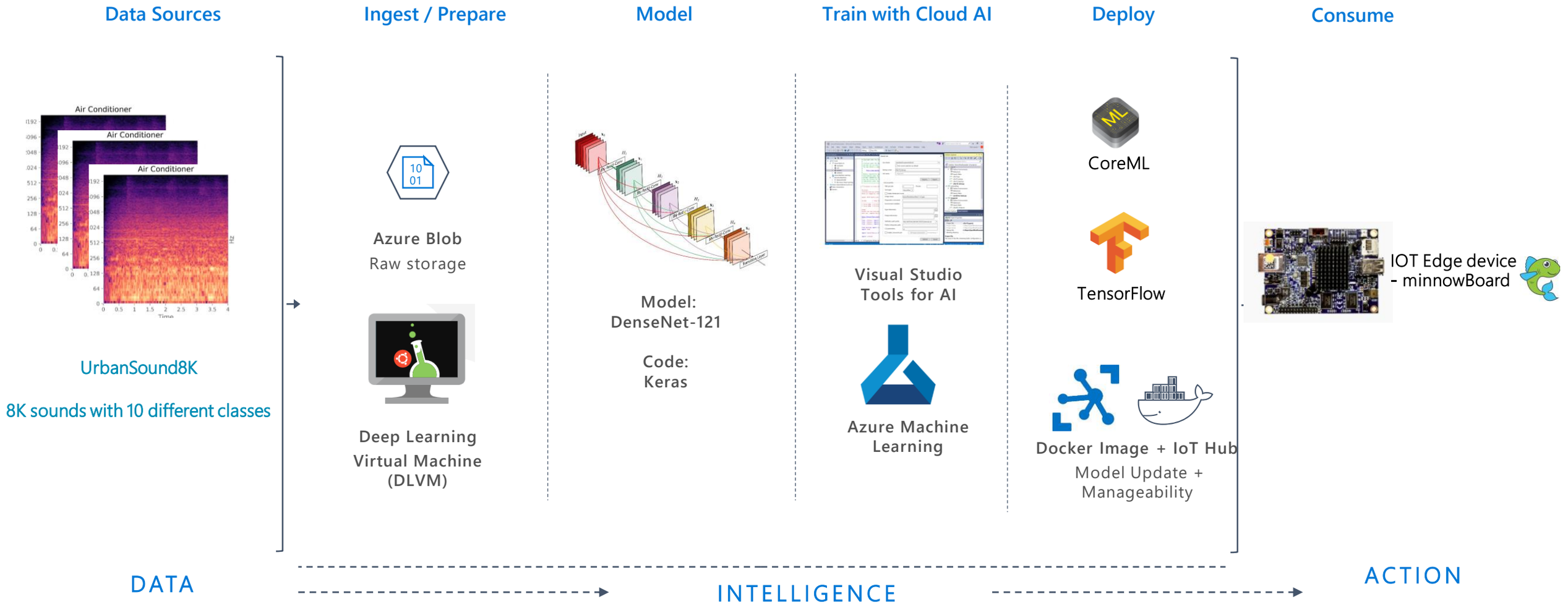




Performance



Deployment: can be utilized by any application



Intelligent Sound Prediction - Architecture

https://aka.ms/hearingaiblog

Open source

Deploy a backend to identify sounds in few minutes!

Resource Links

Microsoft at CSUN
Aka.ms/CSUN2018

Answer Desk for Accessibility Support
aka.ms/eDAD

Microsoft Accessibility Overview
Microsoft.com/Accessibility

We want to hear from you.

Connect with us in person today or anytime through our support and feedback channels.

Disability Answer Desk for phone/chat/ASL Help:
Aka.ms/AccessibilitySupport

User voice Forum for Accessibility Feedback:
Aka.ms/AccessibilityFeedback