MATLAB EXPO 2017
Reusing and Prototyping Code to Accelerate Innovation
The Case of Smart Voice Interfaces
Gabriele Bunkheila
What Device Is This?
- Innovate
- Reuse
- Prototype
System Prototype Demo
Live voice detection, beamforming and speech recognition

[Video placeholder]
What Are Microphone Arrays?
Why Microphone Arrays?
How Can I…

1. Design and simulate a microphone array system?

2. Validate my voice interface can work in real-life scenarios?

3. Understand what else can help me improve my performance?
How Can I…

1. Design and simulate a microphone array system?
Section Overview
From analysing a microphone topology to simulating a beamforming scenario

[Video placeholder]
How To Get Started?
Demo
App-aided exploration of array topologies

[Video placeholder]
Demo
Selecting a set of directionally-selective array configurations

[Video placeholder]
Demo
Simulating time-domain sound acquisition through a microphone array

[Video placeholder]
Demo
Interactive beamforming simulation with voice source

[Video placeholder]
How Can I…

2. Validate my voice interface can work in real-life scenarios?
Constrained Simulations vs. Real Life
Constrained Simulations vs. Real Life
Demo
Streaming live multichannel audio in and out of MATLAB

[Video placeholder]
Demo
Real-time prototyping with live tuning of beamforming algorithms in MATLAB

[Video placeholder]
Demo

Common uses of Digital Audio Workstations (DAW) and audio plugins for sound acquisition and audio enhancement

[Video placeholder]
Demo

Generating VST plugins from MATLAB and prototyping array processing algorithms on Digital Audio Workstations

[Video placeholder]
How Can I…

3. Understand what else can help me improve my performance?
Recap Demo
Using prototypes to brainstorm on incremental improvements early on

[Video placeholder]
How To Measure Performance?

- Output audio "sounds good"
- "91.5% of spoken sentences correctly converted"
Getting Started With a Cloud Service for Speech Recognition

[Video placeholder]
Hide Complexity to Accelerate Reuse

>> [samples, fs] = audioread('hellomatlabexpo.wav');
>> soundsamples, fs)
>> [speechString, confidenceInterval] = speech2text(samples, fs, 'en-US')

speechString =

'hello Matlab Expo'

confidenceInterval =

0.9526
>> noiseRemover = loadAudioPlugin('ERA-N.vst')

noiseRemover =

VST plugin 'ERA-N'  2 in, 2 out

    Processing: 40 %
    Gain: 0 dB
    Tilt: 'NoTilt'
    Bypass: 0

>> noiseRemover.Processing = 60;
>> noiseRemover.Gain = 3;
>> y = process(noiseRemover, x)

https://accusonus.com/products/era-n
Demo
Testing an external audio plugin within a MATLAB live system model

[Video placeholder]
Building a Small Speech Dataset Quickly

Apps enable interactivity and automation.
Building a Small Speech Dataset Quickly
Can you improve speech content labelling?

>> harvard(1)
ans =

10×1 string array

"the birch canoe slid on the smooth planks"
"glue the sheet to the dark blue background"
"it's easy to tell the depth of a well"
"these days a chicken leg is a rare dish"
"rice is often served in round bowls"
"the juice of lemons makes fine punch"
"the box was thrown beside the parked truck"
"the hogs were fed chopped corn and garbage"
"four hours of steady work faced us"
"a large size in stockings is hard to sell"

http://www.cs.cmu.edu/afs/cs.cmu.edu/project/fgdata/OldFiles/Recorder.app/utterances/Type1/harvsents.txt
Building a Small Speech Dataset Quickly
Example: an App with automated content labelling
Demo
Testing speech recognition performance of different design variants (including with new enhancements)

[Video placeholder]
How Can I…

1. Design and simulate a microphone array system?

2. Validate my voice interface can work in real-life scenarios?

3. Understand what else can help me improve my performance?

MATLAB EXPO 2017
System Prototype Demo – Summary and Recap
Live voice detection, beamforming and speech recognition

[Video placeholder]
Summary

- Innovate
- Reuse
- Prototype

Hello
Anyone out there