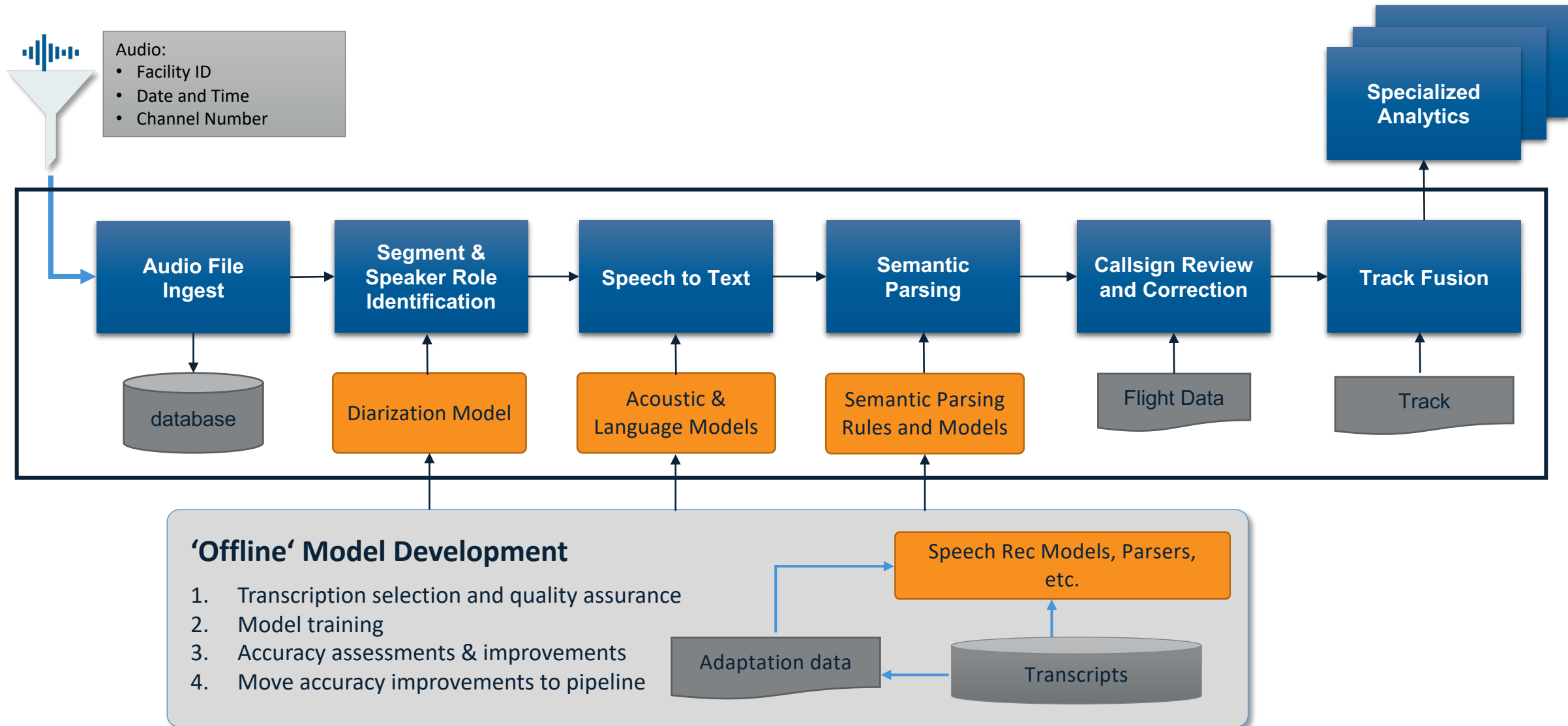


Automatic Speech Processing of United States ATC Speech

Large-scale processing of recorded real-world operations controller-pilot
voice communications

August 30, 2021

MITRE's Speech Processing Pipeline



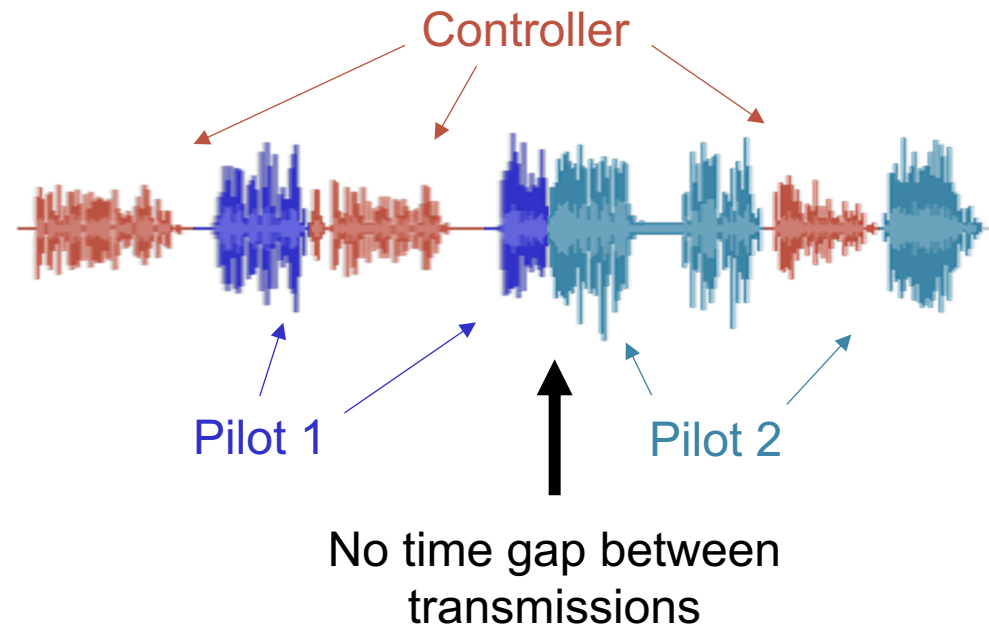
Speaker Role ID & Segmentation – Issue: Short Turns



Challenge: back-to-back transmissions, same speaker role but different speaker

Note: Speaker roles are Pilot & Controller

Example: pilot readback followed closely by pilot call-in



Automatic Speech Recognition – Issue: Waypoints



Challenge: tens of thousands of facility-specific waypoints with custom pronunciations across dozens of facilities

- No official, written pronunciation definitions
- Some are similar sounding within same facility
- Some have multiple pronunciations
- Some have no vowels

Examples:

BINGG vs. VINGS

KWITE
“k white” or “quite”

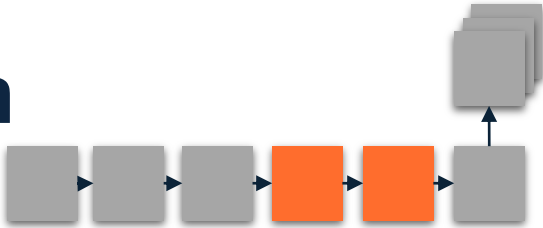
FRDMM sounds like “freedom”

TALTE vs. FALTY

ISACE
“ice ace” or “eye sah chee”

PLFMD sounds like “pluff mud”

Semantic Parsing – Issue: No callsign spoken



Challenge: associating transmissions with a flight when the flight’s callsign is not spoken in the transmission
(about 15% of the transmissions in US ATC speech)

Simple case:

How to label this as UAL860?

Callsign	Speaker	Transcript
UAL860	Controller	United eight six zero descend and maintain flight level two two zero
	Pilot	Two two zero eight six zero

Difficult case:

How to label these as SWA3416?

Callsign	Speaker	Transcript
SWA3416	Controller	<unk> a thirty four sixteen roger the altimeter is three zero zero one what are you descending through
	Pilot	uh eight thousand
	Controller	let me know when you can take a turn towards the northeast i can't leaving three fifty heading you're not there my airspace yet and that's it down at your really won't be on my airspace
	Pilot	yeah we can take the turn now
	Controller	alright roger turn right heading zero six zero
SWA3416	Pilot	zero six zero on the heading uh right turn southwest thirty four sixteen

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