Open-set Microphone Classification via Blind Channel Analysis

Luca Cuccovillo, Patrick Aichroth
Fraunhofer Institute for Digital Media Technology,

Overview

Open-set microphone classification
- Applying SotA method for channel estimation
- No training set required
- Average Rand index greater than 93%, even for MP3 and AAC compressed recordings

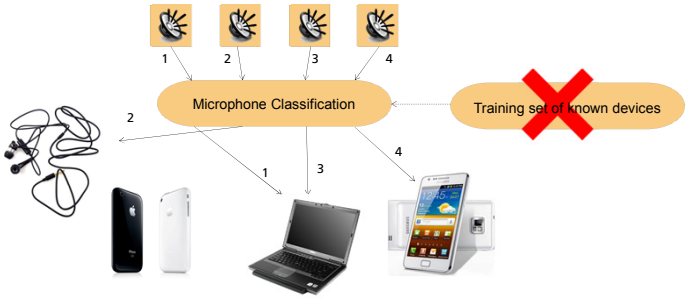

Figure 1 – Open-set microphone classification

Microphone Discrimination

Baseline approach
- One channel estimate per each file
- Based on the correlation between the feature vectors

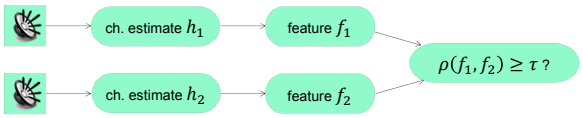

Figure 2a – Baseline approach for microphone discrimination

Enhanced approach
- Several overlapping channel estimates of the spliced file
- Based on the value of the detection function at the splicing point

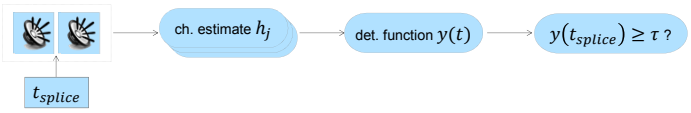

Figure 2b – Enhanced approach for microphone discrimination

Detection function
- Exploits redundancy to increase discriminating power
- Higher discrimination than the baseline
- Tradeoff reliability vs. processing speed can be tuned with parameter δ_1

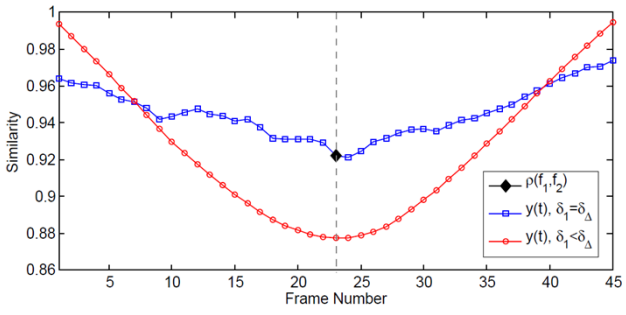

Figure 3 – Visualization of the detection function

Open-set Classification

Greedy open-set classification algorithm
- Amount of known classes increasing on demand
- Complexity linear to the amount of already-detected classes
- Requires a preset threshold τ, responsible for device discrimination

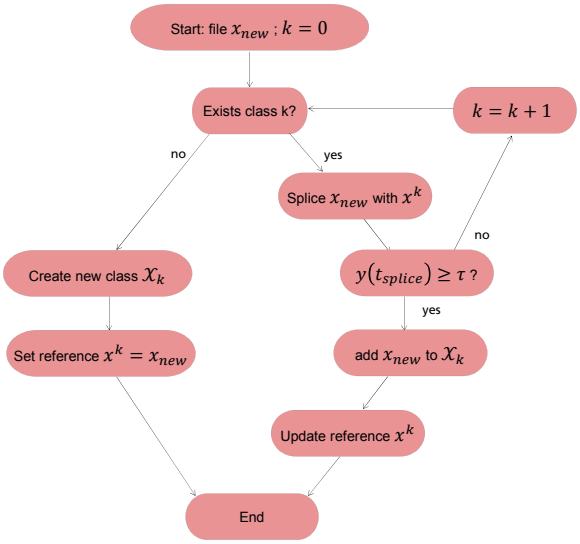

Figure 4 – Open-set classification algorithm

Results and Conclusions

Test set includes different encodings and bit-rates

PCM	48 kHz, mono, 16-bit
MP3	256, 192, 128, 96, 64 (kbps)
AAC	192, 128, 96, 64, 32 (kbps)

as well as different devices

Dell Latitude D630, built-in	Dell Latitude D630, headset
Google Phone G2, built-in	Google Phone G2, headset
iPhone 4S, built-in	iPhone 4S, headset
Samsung Galaxy S II, built-in	Samsung Galaxy S II, headset

Despite being in its early stages, this method proved to be
- Reliable for lossless PCM-encoded recordings
- Reliable for lossy compressed AAC and MP3 recordings

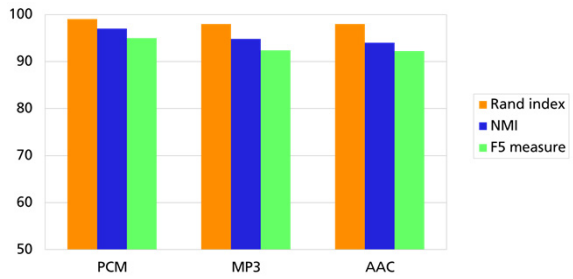

Figure 5 – Classification results with on 8 devices (enhanced discrimination)

QR-code to the project website:
http://s.fhg.de/idmt-audioforensics

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