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Speech Signal Processing (SSV)

Examiners

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Department

Informatik

Labels

Zweittermin

mündlich

I had an oral exam and was well-prepared for all questions that have been asked in the past. I was only thrown off by a few new questions I had not prepared for. My final grade was 2.0

Here are the questions that I remember:

- Please sketch out and explain the source-filter model
- Please also write down the corresponding formulas in time and frequency domain (meaning $s(n) = e(n) * g(n)$ and $S(f) = E(f) \times G(f)$ with convolution and multiplication)
- Please sketch the spectrum of a voiced sound and explain the shape of the sketch (here you have to mention f_0 , the harmonics, and the spectral envelope/formants).
- My sketch included three formant peaks, he asked me what sampling rate this signal probably had (1 formant per kHz, so 3 kHz max frequency, requiring a 6 kHz sampling rate - I did not remember this). Another way of asking this question would be: How many formants would you expect in a typical speech signal? (-> depends on the sampling rate).
- The convolution in time domain requires an infinitely long $g(n)$, what can we do instead? -> I wrote down the ARMA formula
- Okay, so this helps, but *why* does this remove the infinite convolution? And is the impulse response of ARMA finite or infinite? -> I was struggling to answer this properly. Apparently the answer to "why" is that we replace the infinite convolution with recursion (in the AR part). The impulse response of the MA part is finite, and the impulse response of the AR part is infinite (because of the recursion). Not being able to answer this properly was the main reason for not getting a better grade. I was also not able to explain properly what an impulse response is.
- How do we get the parameters for the ARMA model? -> write down MMSE arg min formula and explain it
- How do we measure the quality of quantization methods? -> SNR formula, then write down the formula for the P_N part
- some questions on which quantization methods I know and the figure with the 6dB change (I don't remember the exact details)
- topic change to Wiener Filter, writing down the formula for $G(f)$
- follow-up question where I was asked to write down the formula for variance (I blanked and did not

remember it)

- topic change to Bayes, write down the formula for the posterior in the context of speech/silence -> $P(H1|Y)$, explain what is $H1$
- how can we write this differently using Bayes formula? -> $P(H1)P(Y|H1) / P(Y)$
- what are these three parts called? -> prior, likelihood, evidence
- topic change, name two types of beamforming and explain one (I chose delay-and-sum)
- what determines the delay between the two microphones? -> the distance between the microphones -> okay, but if they have a fixed distance, e.g. in a laptop, what then? -> the angle between microphones and sound source

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