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Speech Signal Processing (SSV)

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Department	Informatik

The exam was conducted via Zoom, and the setup consisted of a webcam with microphone, an empty paper and a second camera filming what we were writing.

1) He started explaining a bit of speech production mechanism, and then he asked me to write a model for speech production --> source-filter model.

- Explain and label the parts of the model.
- Write the mathematical equation that summarizes the model --> $s(n) = e(n) * h(n)$.
- Transform the formula into a convolution and then into a finite recursive equation (ARMA equation).

2) Draw $e(n)$, $h(n)$ and $s(n)$ in the frequency domain.

- He asked me some theoretical questions about formants, excitation signal and what each of those produced in the final speech sound.

3) Explain the process of converting an analog signal into digital.

- Sampling + sampling theorem.
- Explanation of what quantization is.
- Some questions about standard fs (8 KHz, ...).
- How can uniform quantization works and how can it be improved.

4) SNR: Some questions about how the formula is derived, how it changes as power is modified and to explain the concept of overload.

5) Single - channel speech enhancement.

- He asked to write : $Y = S + N$.
- Then, he asked me to write one of the ways we can enhance speech: I wrote MMSE of the STFT domain S and S^.
- And then to write the result of the MMSE development --> Wiener Filter.

6) Multi - channel speech enhancement.

- Explain the problem with time delay.
- The 2 types of beamformers.

- Write the Wiener Filter for multichannel enhancement.