Digital Signal Processing for Music

Part 25: Waveform Coding

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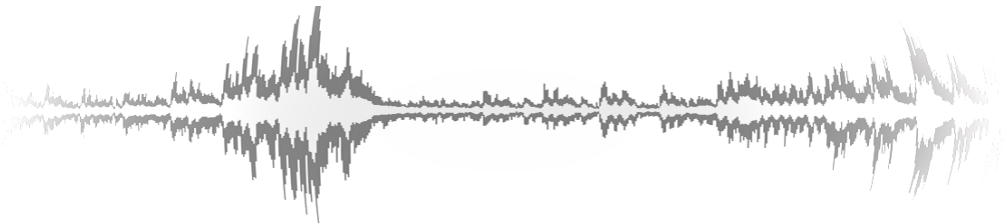

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waveform coding

introduction

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- **goal**:
  - encode waveform in a way that the decoded waveform is as close to the original waveform as possible

- **approaches**:
  - PCM (analogue to digital)
  - non-linear quantization
    - Question: how is the principle of non-linear quantization related to Entropy coding?
  - **DPCM & ADPCM**

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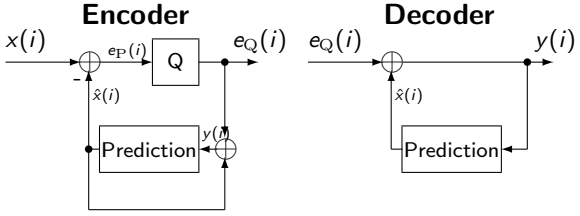
DPCM



- predictor is updated from **reconstructed signal**
  - no transmission of predictor coefficients necessary
  - *reconstruction error*

$$\begin{aligned} r(i) &= x(i) - y(i) \\ &= x(i) - (\hat{x}(i) + e_{\mathrm{Q}}(i)) \\ &= e_{\mathrm{P}}(i) - e_{\mathrm{Q}}(i) \\ &= q(i) \end{aligned}$$

$\Rightarrow$ reconstruction error **identical** to quantization error

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ADPCM

- ADPCM:
  - coefficient **adaptation for every block of samples**
  - quantization step size (scale) adjusts to signal power

- **forward adaptive** implementation
  - coefficients are *calculated from the input* signal and *transmitted*
  - *robust* against transmission errors
  - requires *additional side information* (coefficients)

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summary

- waveform coding aims at efficiently representing the time domain signal
- **idea**: non-redundant parts are quantized (lossy) according to transmission bandwidth

- **advantages**:
  - low latency
  - low complexity
  - high quality at high bitrates

- **disadvantage**:
  - quality loss is attempted to minimize waveform similarity

  $\Rightarrow$ not perceptually meaningful

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