Introduction to **Audio Content Analysis**

module 3.2.5: fundamentals — blocking

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introduction
overview

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corresponding textbook section

section 3.2.5

- **lecture content**
  - splitting the audio signal into blocks
  - block length and hop size

- **learning objectives**
  - describe the reasons for blocking
  - summarize the principle using the correct terminology

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block based processing
introduction

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- typical audio applications **process blocks** of audio data
- instead of having a function called per sample, it is called with block of samples

- **reasons**:
  - block based processing methods such as the Short-Time Fourier Transform
  - audio hardware characteristics (real-time systems)
  - efficiency (memory allocation, SIMD)

- typical block lengths:
  - 1. . . thousands of samples
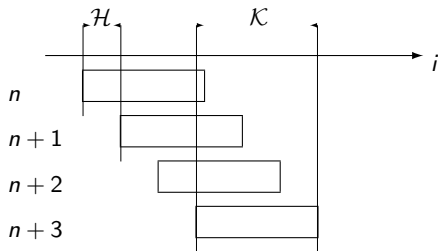 - often powers of 2 (1024, 2048, ...)

block based processing
introduction

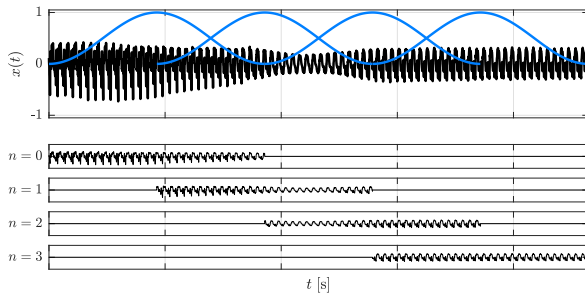Georgia | Center for Music
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block based processing
description

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- $\mathcal{K}$: block length
- $\mathcal{H}$: hop size
- n: block index
- i: sample index

matlab source: plotBlocking.m

block based processing
terms and definitions

- **block boundaries**:

$$
\begin{aligned}
i_{\mathrm{s}}(n) &= i_{\mathrm{s}}(n-1) + \mathcal{H} \\
i_{\mathrm{e}}(n) &= i_{\mathrm{s}}(n) + \mathcal{K} - 1
\end{aligned}
$$

- **overlap ratio**:

$$
o_{\mathrm{r}} = \frac{\mathcal{K} - \mathcal{H}}{\mathcal{K}}
$$

- **time stamp**:

$$
t_{\mathrm{s}}(n) = \frac{i_{\mathrm{e}}(n) - i_{\mathrm{s}}(n) + 1}{2 \cdot f_{\mathrm{S}}} + \frac{i_{\mathrm{s}}(n)}{f_{\mathrm{S}}} = \frac{\mathcal{K}}{2 \cdot f_{\mathrm{S}}} + \frac{i_{\mathrm{s}}(n)}{f_{\mathrm{S}}}
$$

- $\mathcal{K}$: block length
- $\mathcal{H}$: hop size
- n: block index
- i: sample index
- f_{S}: sample rate

summary
lecture content

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- **audio signal is typically split into blocks**
- each block processed individually
- **terms**:
    - *block length*:
        - ▶ minimum: 1
        - ▶ typical: 256...16384
    - *hop size*:
        - ▶ minimum: 1
        - ▶ maximum: block length
        - ▶ typical: half of block length
    - block *time stamp*:
        - ▶ typically refers to either start or middle of block