Exploiting Attention-based Sequence-to-Sequence Architectures for Sound Event Localization

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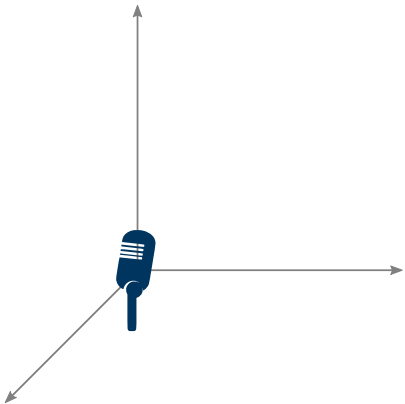
Problem statement

Sound event localization (SEL) aims at finding the positions of *active* sound sources in the environment



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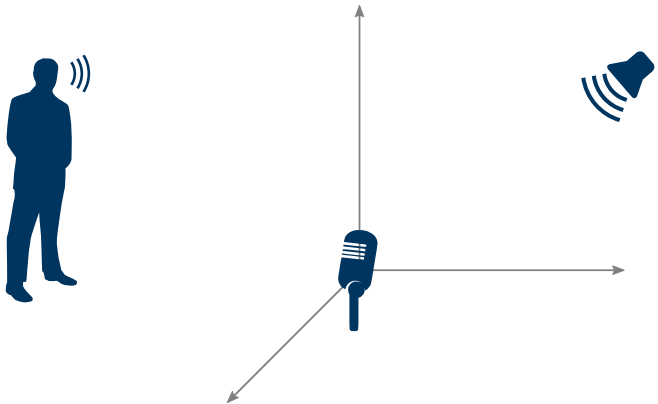

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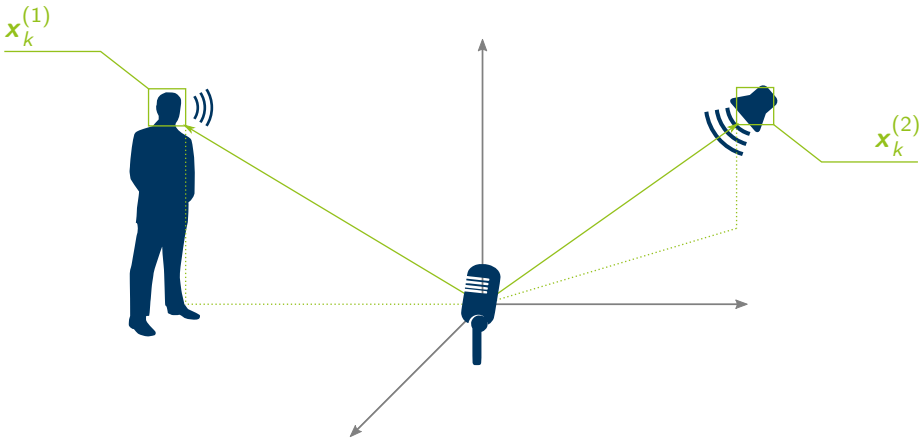

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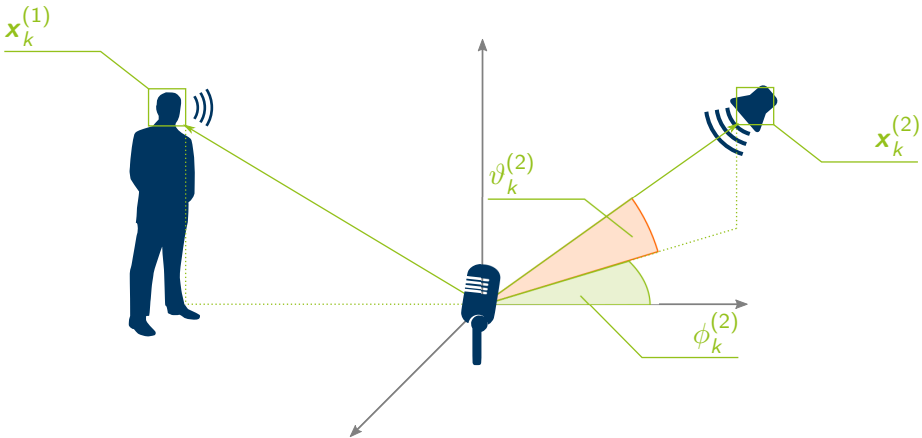
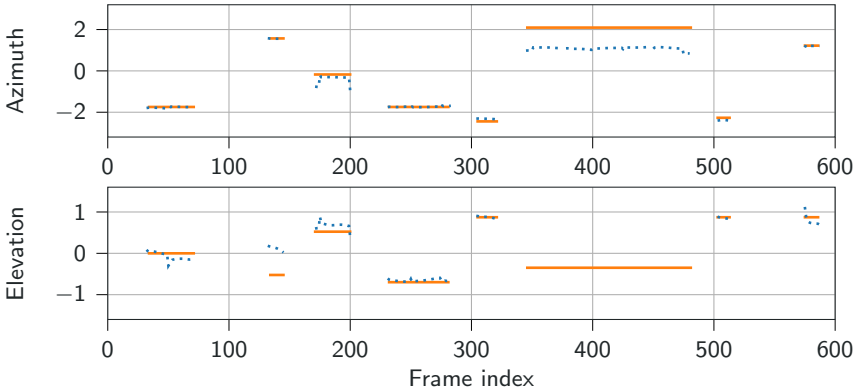


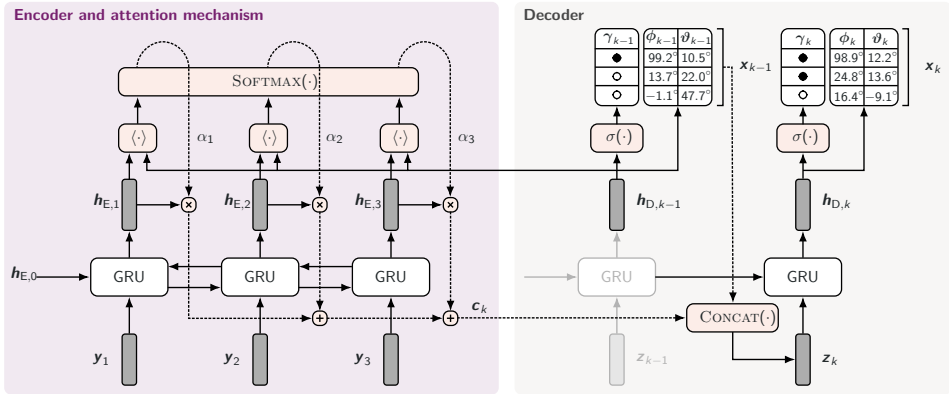
A deeper look into sound event localization

Source activity and position can change over time and multiple sources can be active simultaneously



Proposed framework: ADRENALINE[1]

A sequence-to-sequence model with attentions is a suitable framework to handle temporal context



[1] Attention-based Deep Recurrent Neural-Network for Localizing Sound Events

Datasets and baseline models for evaluation

Experimental evaluation covers multi-source SEL datasets with various acoustic conditions

- A subset from the **TUT Sound Events 2018**[2] corpus was used for evaluation:
  - ANSYN: Anechoic and synthetic impulse responses
  - RESYN: Reverberant and synthetic impulse responses
  - REAL: Reverberant and real-life impulse responses

[2] A. Adavanne, J. Politis, J. Nikunen and T. Virtanen, "*Sound event localization and detection of overlapping sources using convolutional recurrent neural networks*", IEEE JSTSP, 2019

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- The signals are composed of **up to 3 simultaneously active sound sources** at different locations, taken from **11 different sound event classes**.
- ADRENALINE uses the same **CNN-based feature extraction** initially proposed for **SELDNet**[2], which are also used as baseline methods here.

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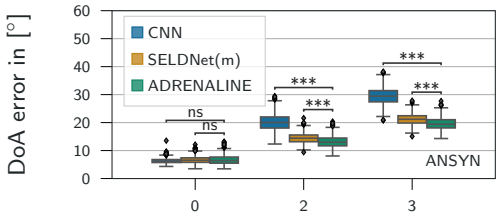
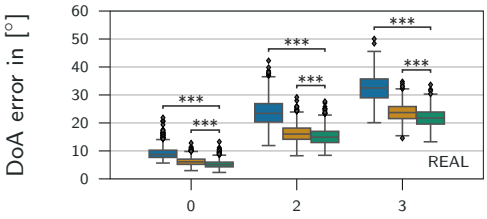
Results

ADRENALINE outperforms baseline methods in terms of DoA error and yields comparable frame recall

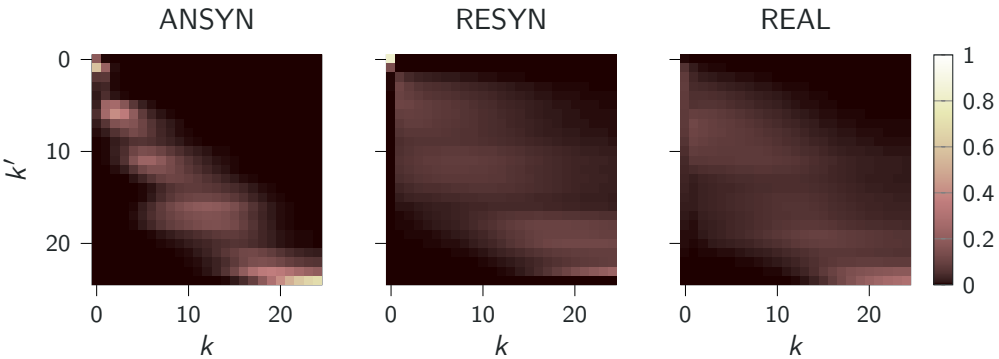




Frame recall	ANSYN	RESYN	REAL
CNN	**87.48**	71.91	72.07
SELDNet(m)	85.78	**72.46**	69.63
ADRENALINE	84.83	71.18	**72.08**

What can the attentions tell us?

Reverberant environments force the model to utilize larger temporal context for SEL



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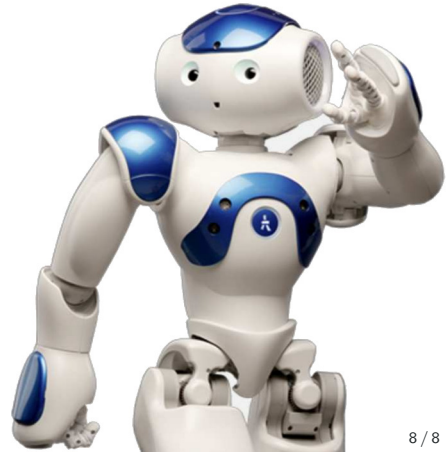

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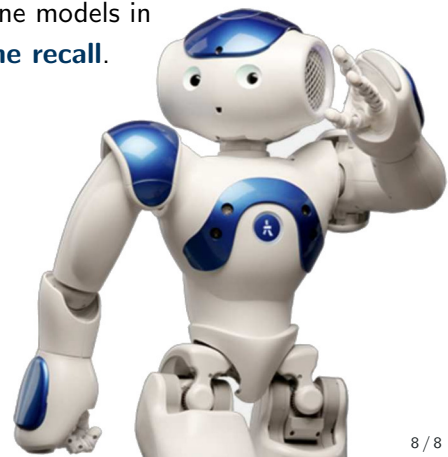

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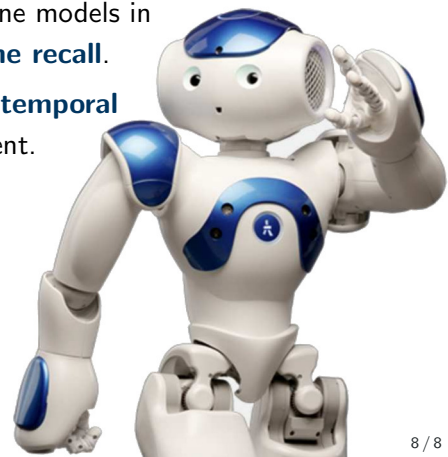
- Attentions enable the model to **adapt** the utilized **temporal context size** depending on the acoustic environment.



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Thank you for your attention!