Hybrid Network For End-To-End Text-Independent Speaker Identification

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Abstract

- Speaker identification system for practical scenario.
- An end-to-end hybrid architecture HWSTCNN: convolutional neural network (CNN) and Wavelet Scattering Transform (WST).
- WST is used as a fixed initialization of the first layers of a CNN network.
- The proposed hybrid architecture provides satisfactory results under the constraints of short and limited number of utterances.

Material and Methods

- The wavelet scattering transform (WST) [1], is a deep representation, obtained by iterative application of the wavelet transform modulus.

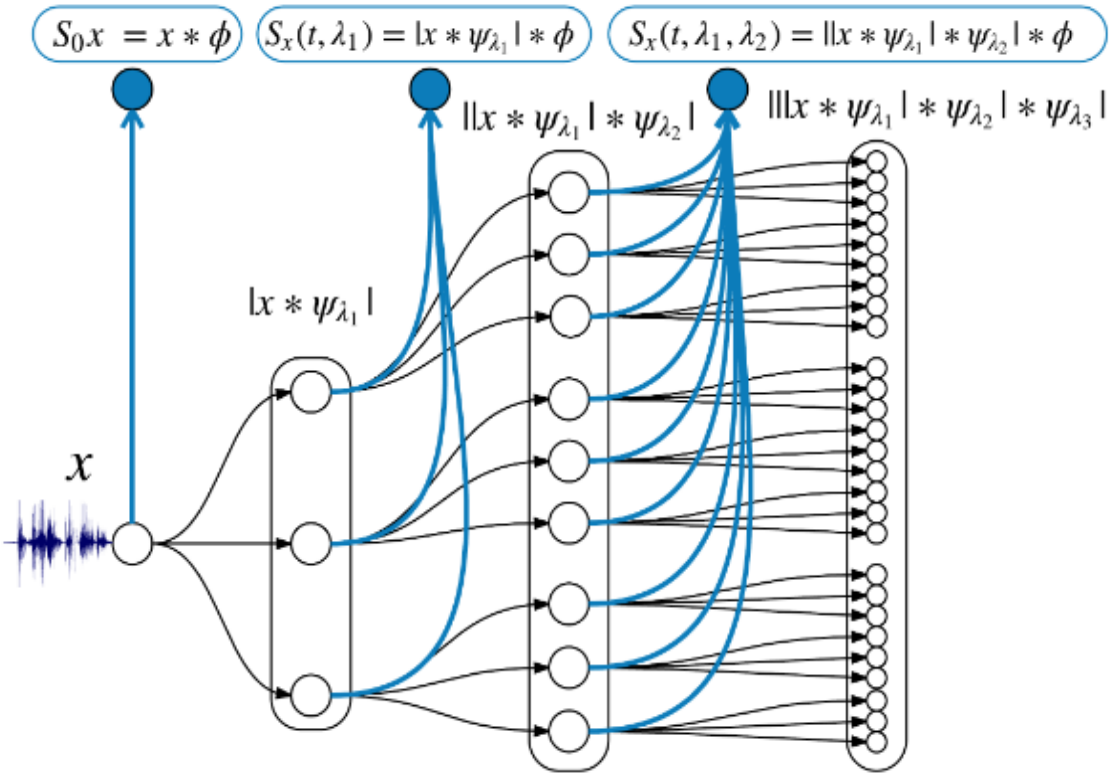
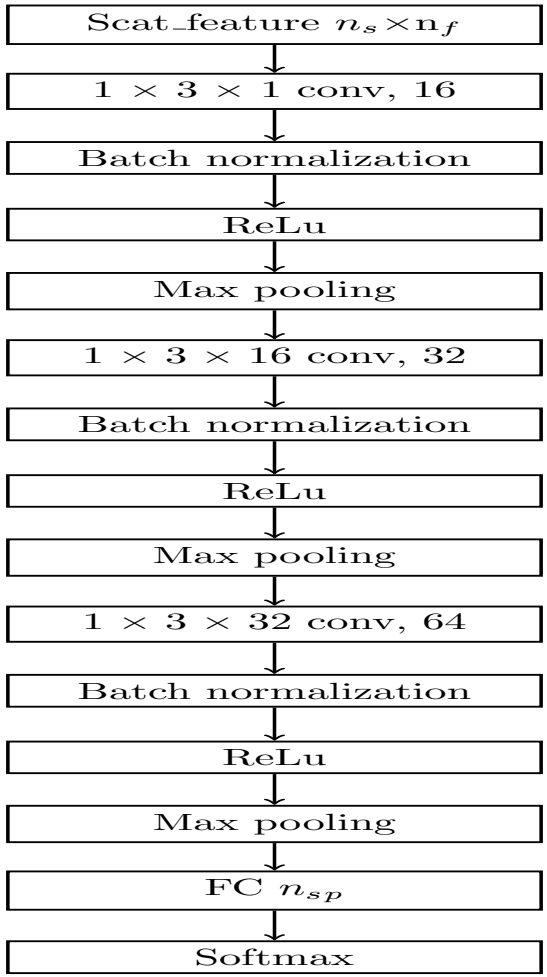


Figure: Hierarchical representation of wavelet scattering coefficients at multiple layers [1].

Material and Methods

- The proposed hybrid network:



Experiment & Results

- Experiments on TIMIT [2] and LibriSpeech [3].
- 462 speakers from TIMIT. 5 sentences for training (15s in total) and 3 sentences for testing.
- 2484 speakers from LibriSpeech database. 7 utterances for training (12-15s in total), and 3 utterances for testing.
- Experiments are only conducted with raw waveforms of length of 2 and 4 seconds.

Experiment & Results

- Comparaison with SincNet [4], CNN-Raw [5].

	LibriSpeech	**TIMIT**
CNN-raw	98.91	98.62
SincNet-raw	98.93	**99.13**
HWSTCNN	**99.28**	98.12

Table: Identification accuracy rate (%) of the proposed HWSTCNN and related systems trained and tested with full utterances.

Experiment & Results

- Effect of training and testing utterances duration per speaker on performances:

Test	Train utterance duration		
	8s	**12s**	**full**
1.5s	96.86	97.20	97.38
3s	98.76	98.93	98.97
full	99.12	99.25	99.28

Table: Identification accuracy rate (%) of the proposed HWSTCNN on LibriSpeech dataset trained and tested with different utterances durations.

Experiment & Results

- Effect of short utterance duration on HWSTCNN , SincNet [4] and CNN-Raw [5].

	SincNet-raw	**CNN-raw**	**HWSTCNN**
1.5s-full	91.51	94.28	**97.38**
3s-full	97.57	96.87	**98.97**

Table: Identification accuracy rate (%) of the proposed HWSTCNN and related systems trained on LibriSpeech dataset and tested with different utterances durations.

Conclusion & Future Work

- Effectiveness of this hybrid architecture with limited data.
- Significant improvements over SincNet, CNN-Raw.
- Ability to reduce the required depth and spatial dimension of the deep learning networks.
- Feature work: Evaluate HWSTCNN on Voxceleb.

References

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