Invariances and Data Augmentation for Supervised Music Transcription

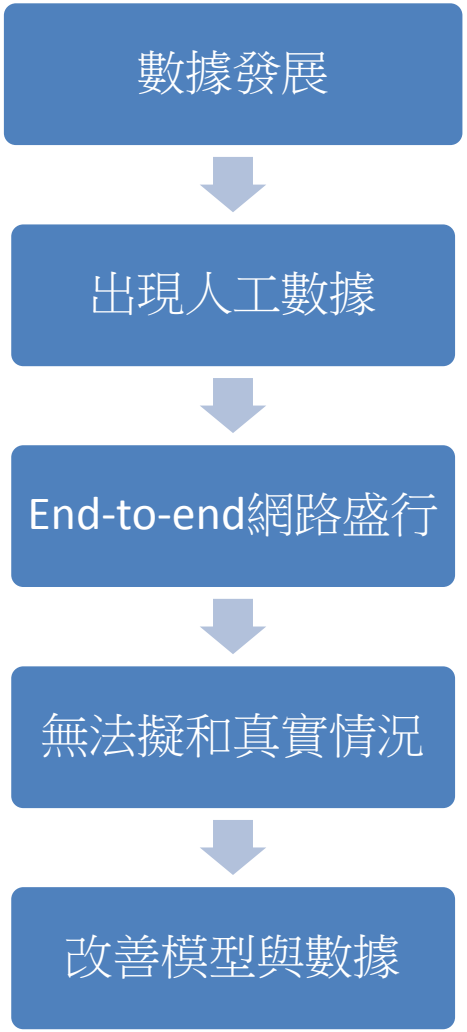
Published in: 2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)

7107018026

統研一 劉俊廷

Contents

Introduction



Introduction

Model	Prec.	Rec.	Acc.	Etot
MIREX 2009 Dataset				
THK1	82.2	78.9	**72.0**	**.316**
KD1	72.4	81.1	66.9	.419
MHMTM1	72.7	78.2	65.5	.441
WCS1	64.0	80.6	59.3	.569
ZCY2	62.7	56.2	50.6	.601
Su Dataset				
THK1	70.1	54.6	**51.0**	**.529**
KD1	45.9	45.0	38.1	.745
WCS1	63.6	39.7	35.7	.700
MHMTM1	61.2	36.8	35.2	.676
ZCY2	40.9	28.2	26.2	.799

Methods

本文考慮的模型可以分成三大類:

1.Filter bank:

概念:藉由filter去篩選特徵值，以減少網路參數

1. **Short-time Fourier transform**
2. **Log-spaced filterbank**
3. **Windowed filterbank(cosine window:1-cos(t))**

$$filter_k = \left(w_{k,\sin}^T x_t\right)^2 + \left(w_{k,cos}^T x_t\right)^2$$

Methods

2.Translation-invariant:

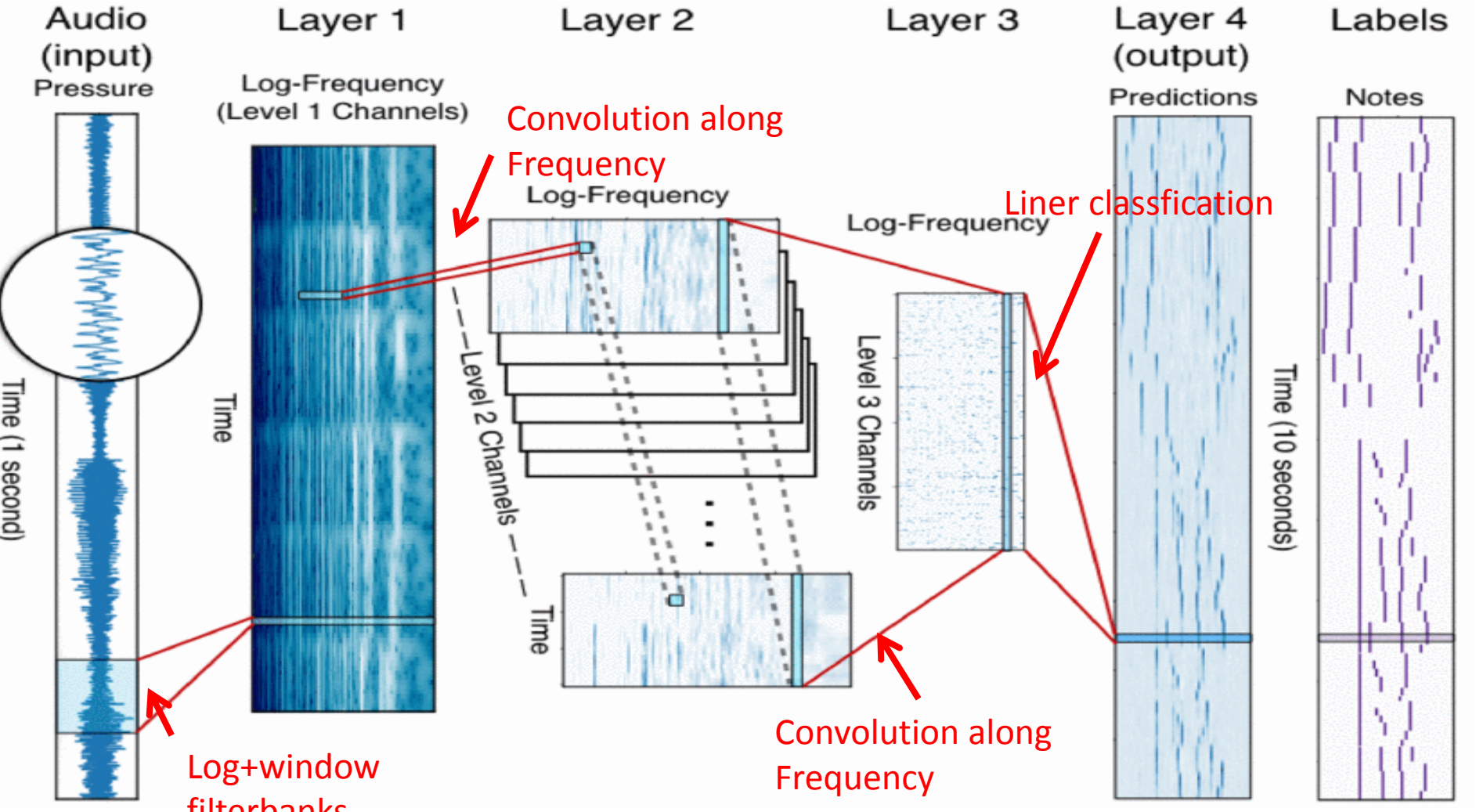
概念:依照頻率的平移不變性概念改進網路，使網路保留頻率的空間關係

1.baseline

2.pitch-shift（使用音高變換優化）

3.wide layer 3(增加第三層節點量）

Methods


Audio (input)
Pressure
Time (1 second)
Layer 1
Log-Frequency (Level 1 Channels)
Time
Convolution along Frequency
Layer 2
Log-Frequency
Level 2 Channels
Time
Layer 3
Log-Frequency
Level 3 Channels
Liner classfication
Layer 4 (output)
Predictions
Time (10 seconds)
Labels
Notes
Log+window filterbanks
Convolution along Frequency

Methods

3.end-to-end:

1.three layer network

2.channel convolution(類似Translation-invariant的結構)

Training

- dataset:

  MusicNet
- 學習模式:

  momentum(ρ=.95)
- 資料增強:

  對頻域中的音調做偏移(+-5半音)，藉此增加資料，可有效強化Translation-invariant network，也對每個數據點移動[-1，1]的位置

Results

Model	Avg. Prec.	Acc.	Err.
filterbanks			
STFT (no compress)	40.4	15.9	.860
STFT	60.4	36.2	.681
log frequencies	62.7	39.8	.646
cosine windows	66.1	38.7	.637
log + windows	66.7	38.9	.633
three layer network	73.8	51.4	.541
end-to-end			
learned filterbank [7]	67.8	48.9	.634
three layer network	70.8	48.8	.558
deep complex [12]	72.9	-	-
channel convolution	73.3	50.4	.531
translation-invariant			
baseline	76.5	53.2	.496
pitch-shift	77.1	54.5	.482
wide layer 3	**77.3**	**55.3**	**.474**
commercial software			
Melodyne [22]	58.8	41.0	.760

Thanks for listening