Time Dependent ARMA for Automatic Recognition of Fear-Type Emotions in Speech

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Outline

1. **Introduction**
2. Methodology
3. Databases and experiments
4. Results
5. Conclusion

1. Introduction

Recognition of emotion in speech:

- ✓ Call centers
- ✓ Emergency services
- ✓ psychological therapy
- ✓ Intelligent vehicles
- ✓ Surveillance

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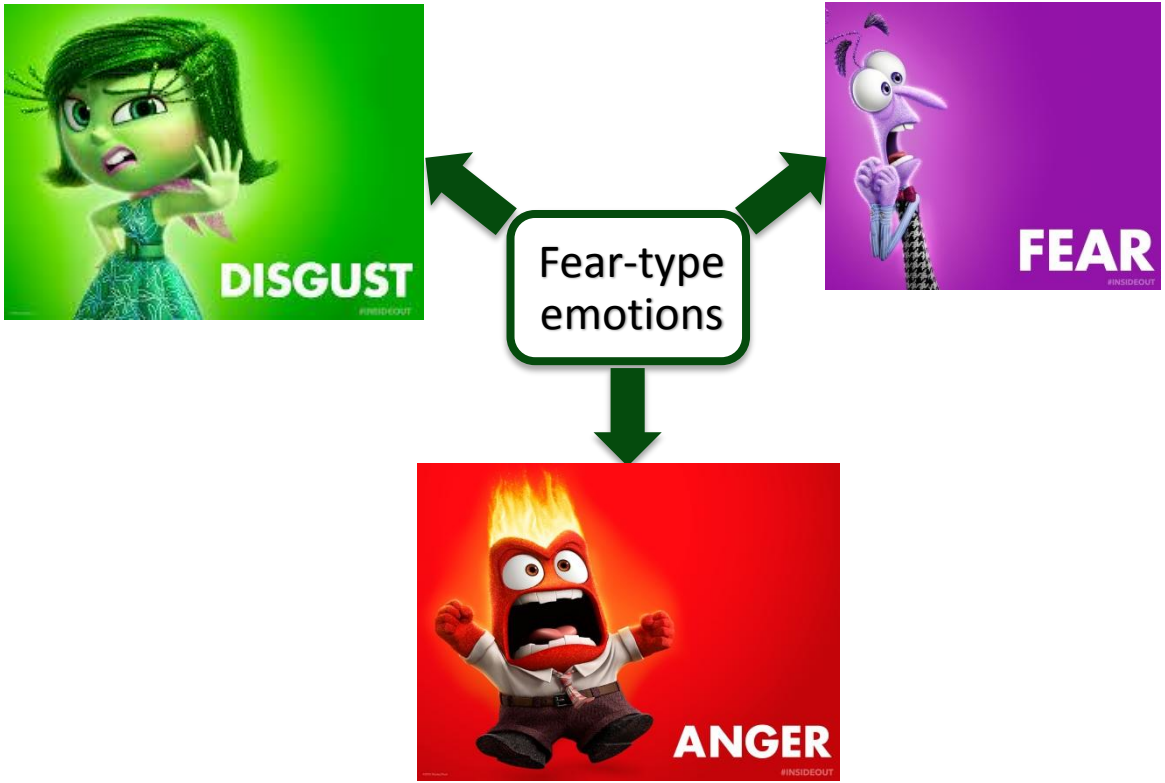
1. Introduction



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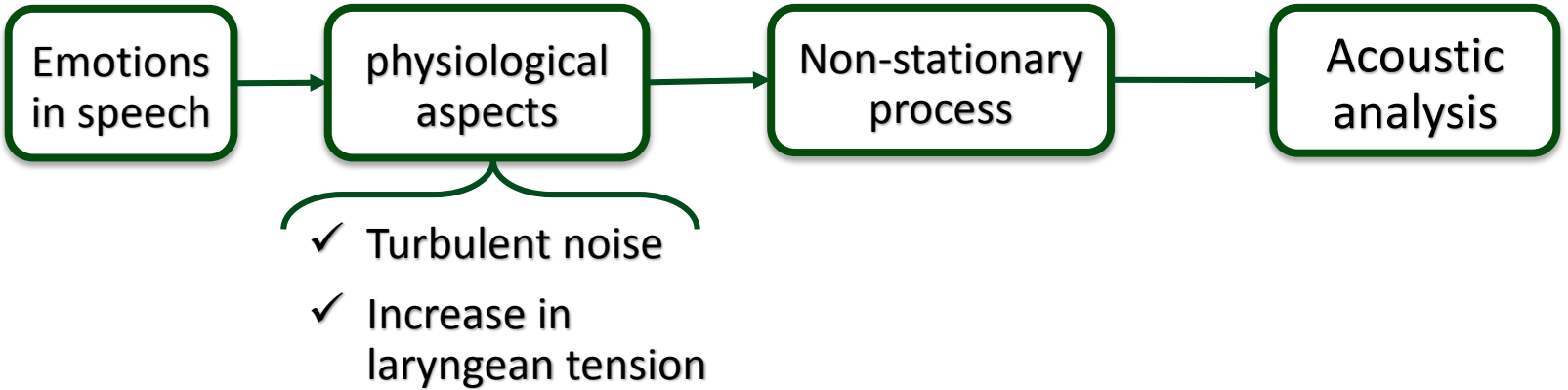

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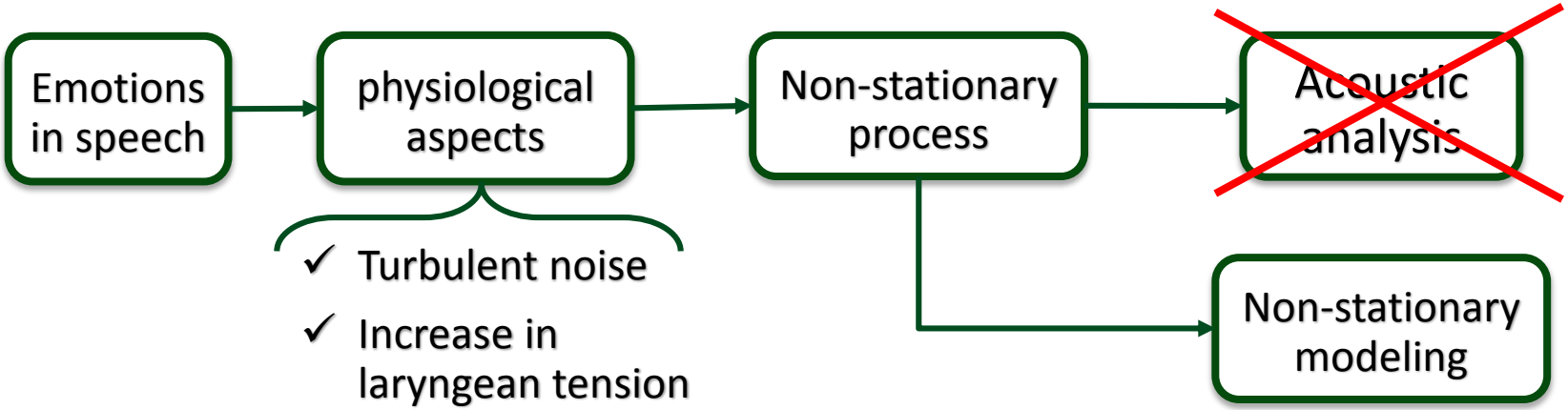

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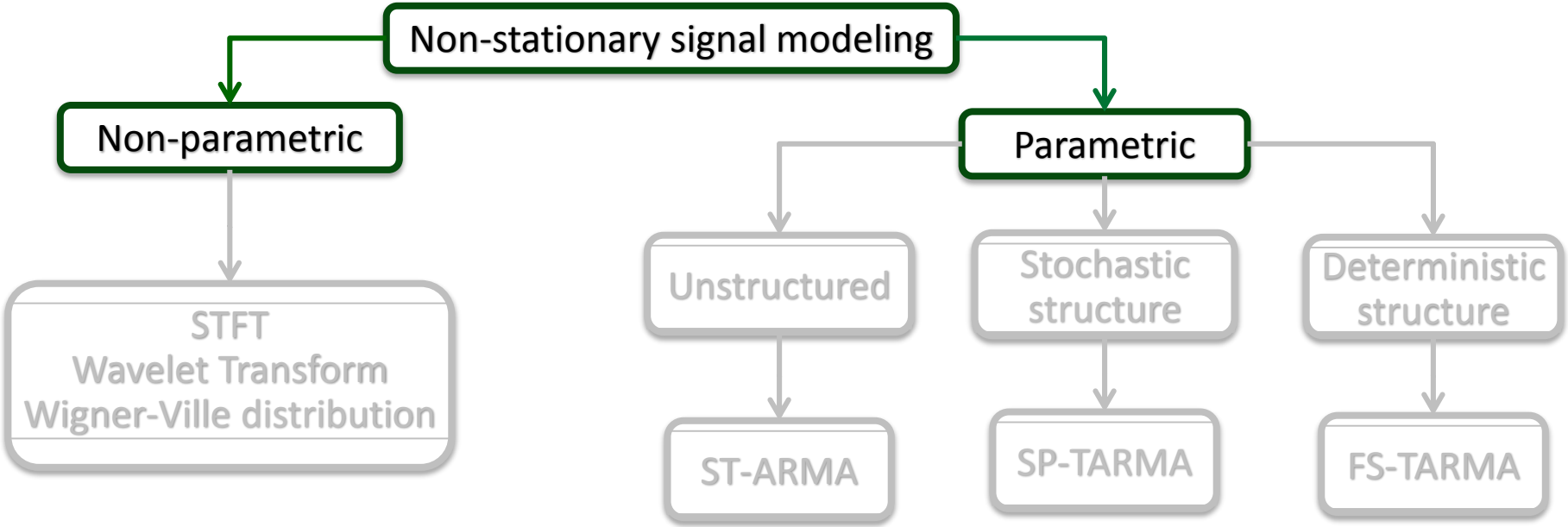

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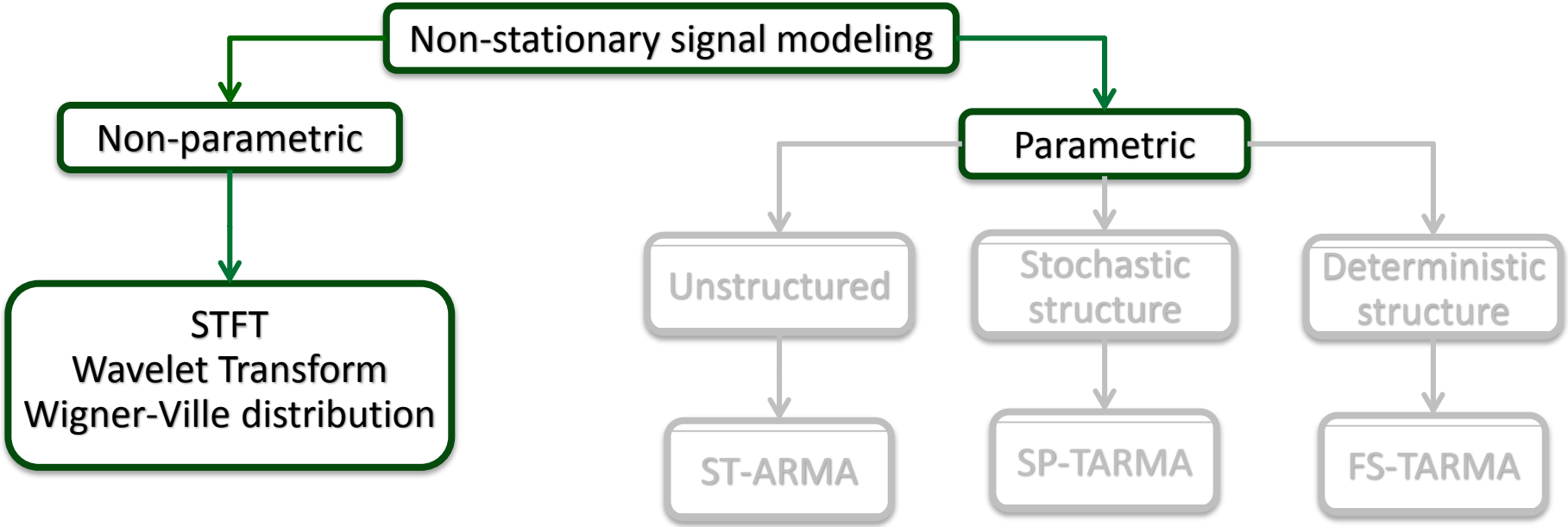

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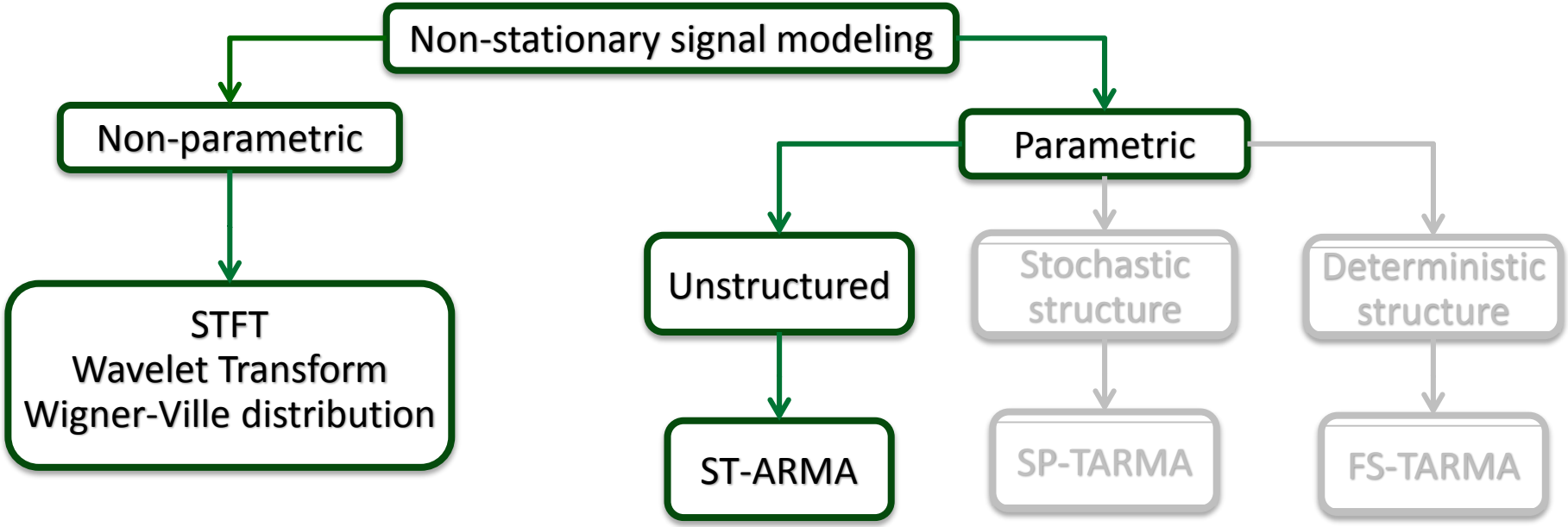

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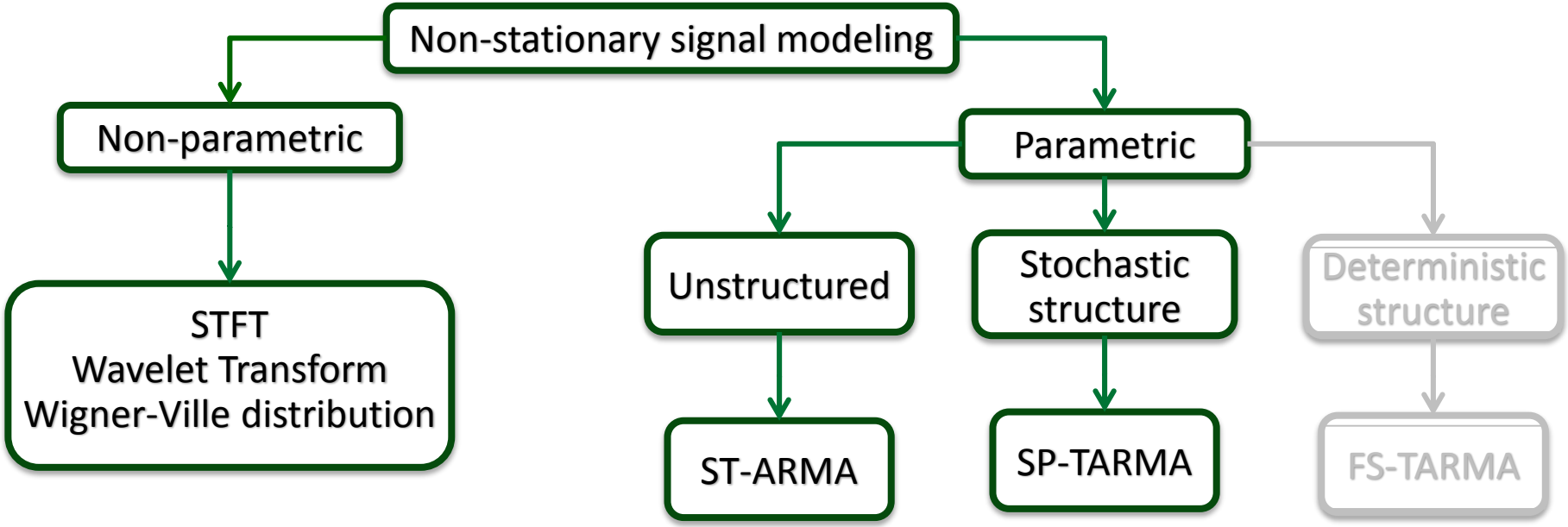

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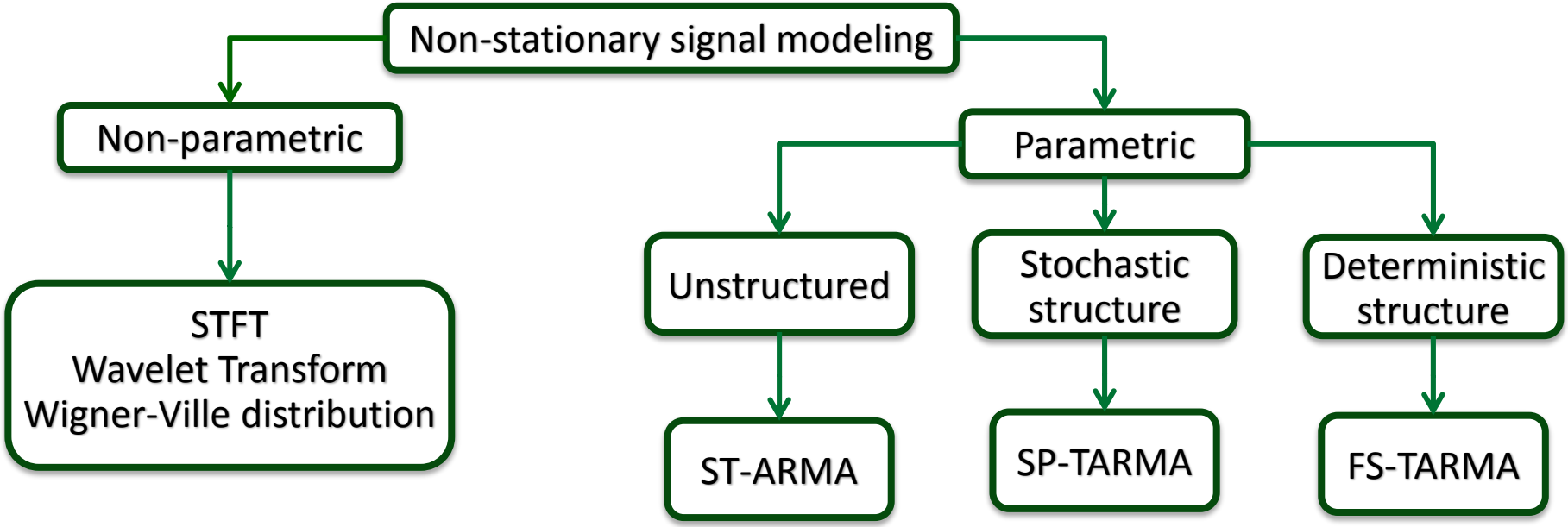

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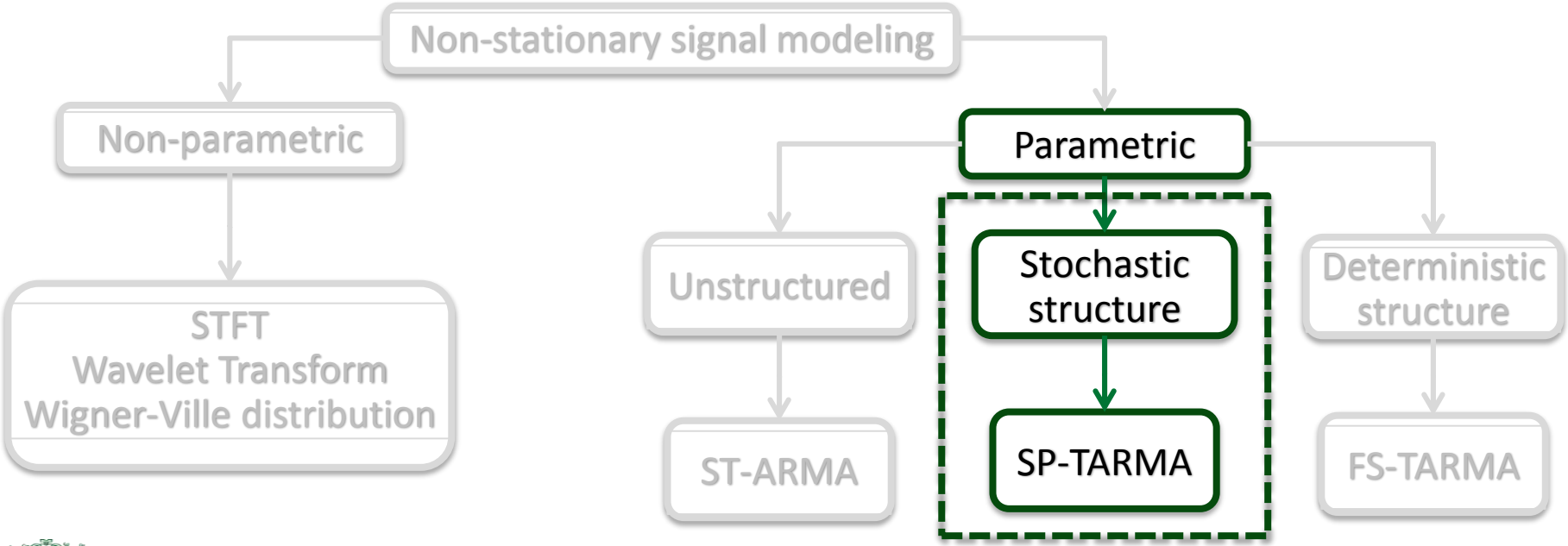

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2. **Methodology**
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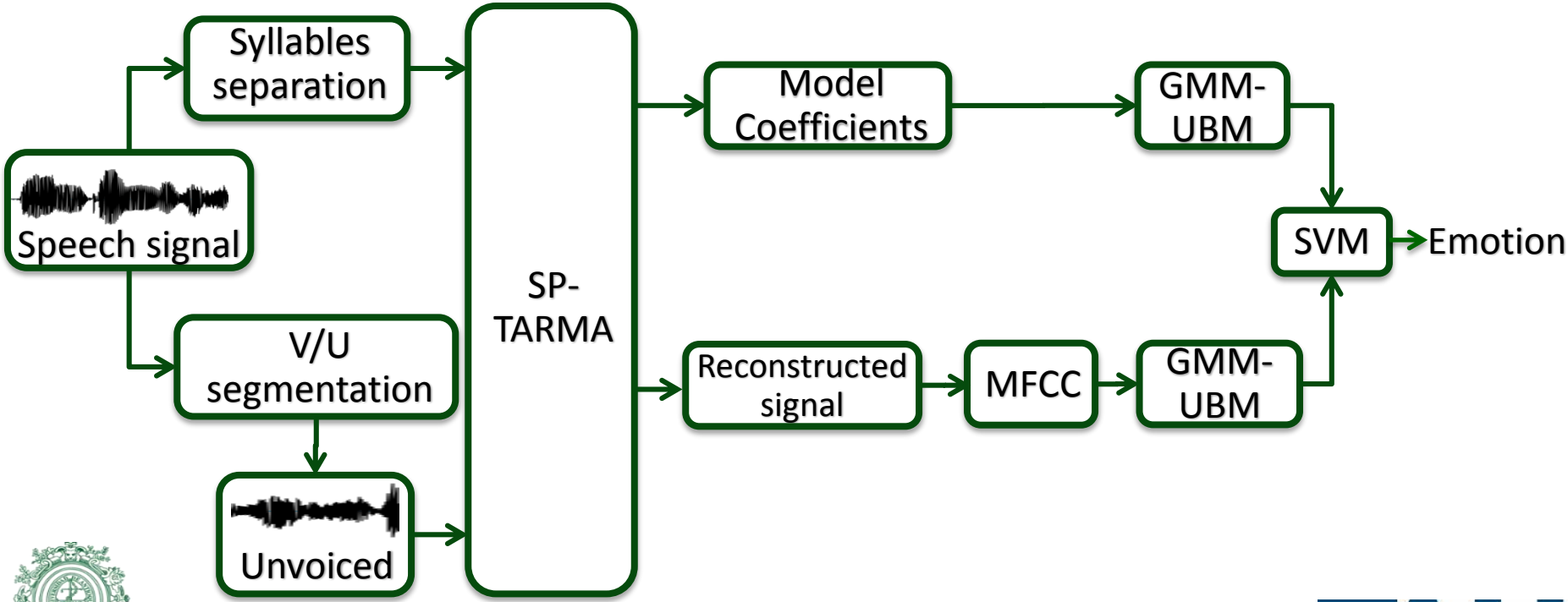
2. Methodology



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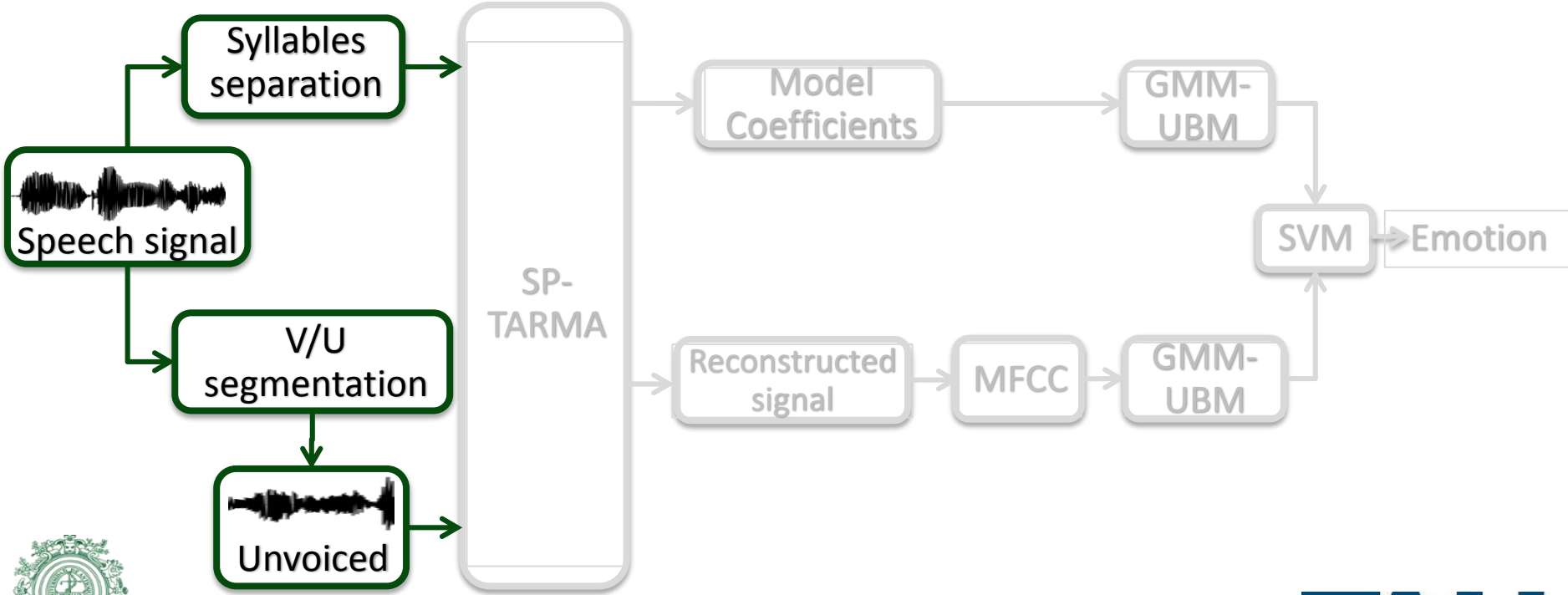
2. Methodology

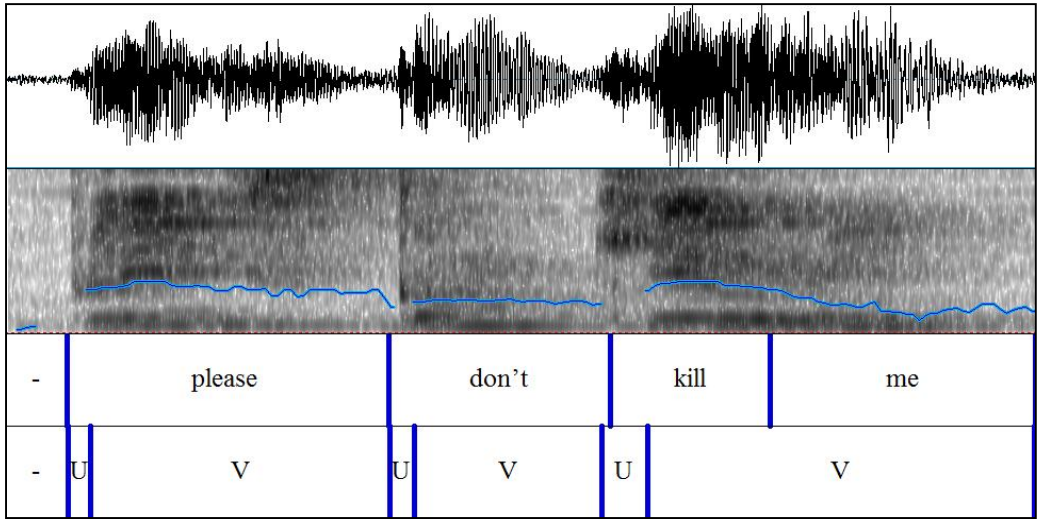


2. Methodology

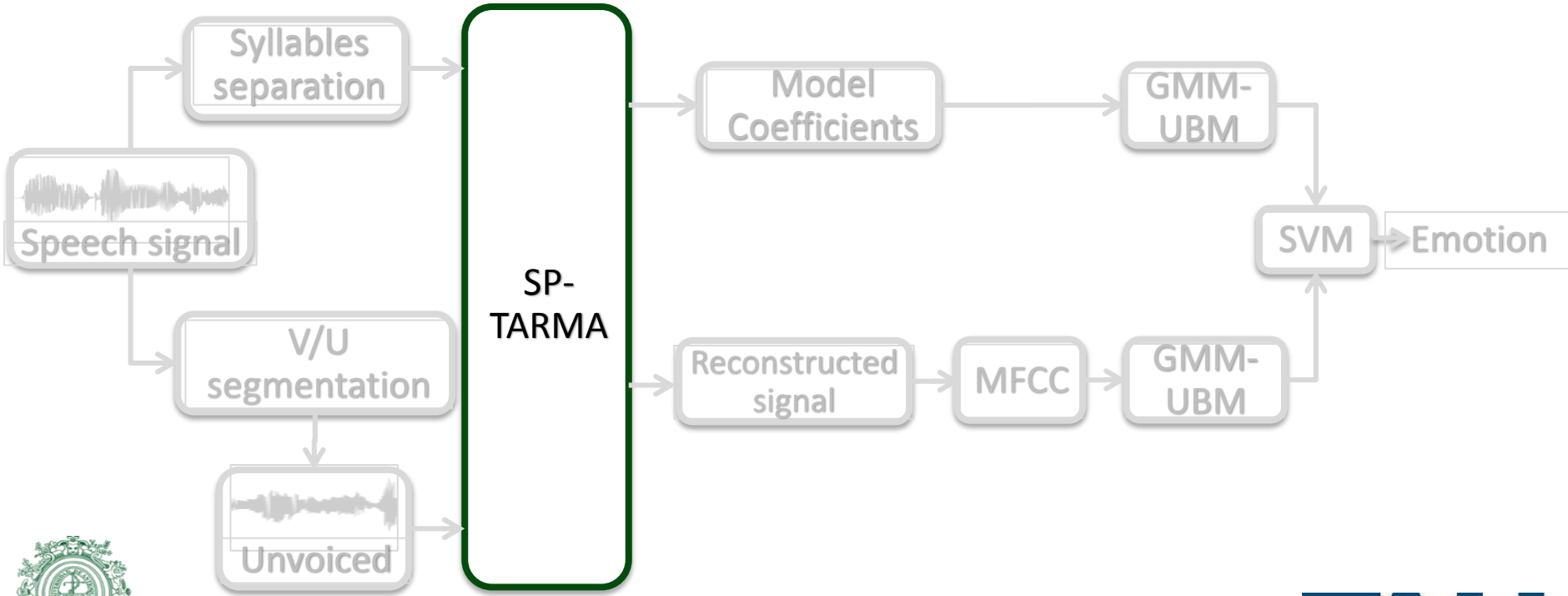
Segmentation

Two types of segments are analyzed:

- ✓ Syllables
- ✓ Unvoiced

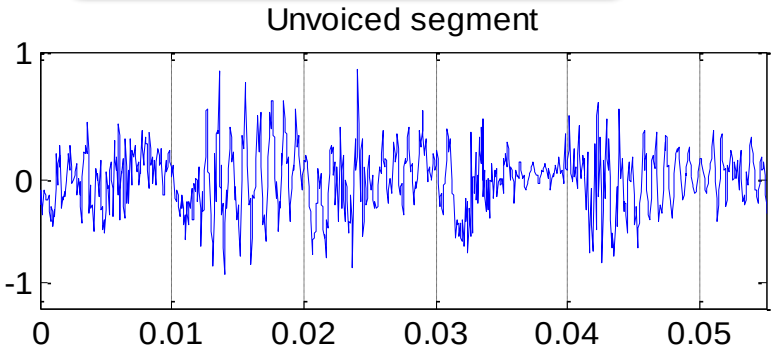


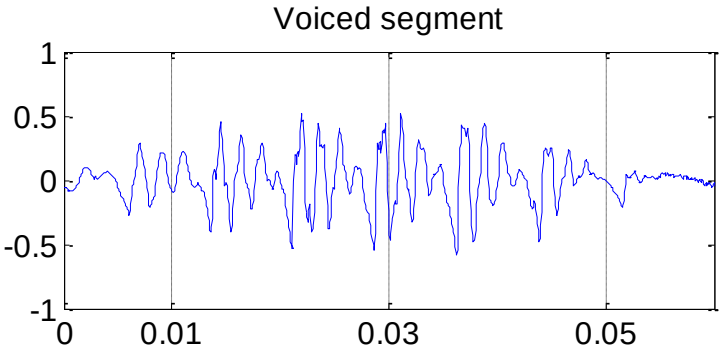
2. Methodology

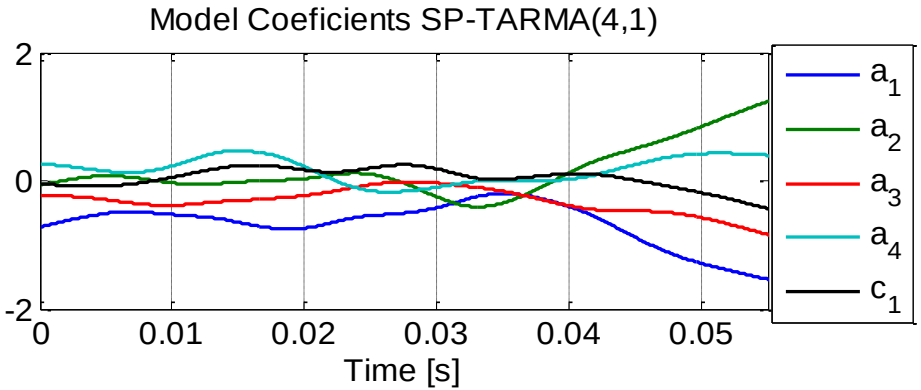


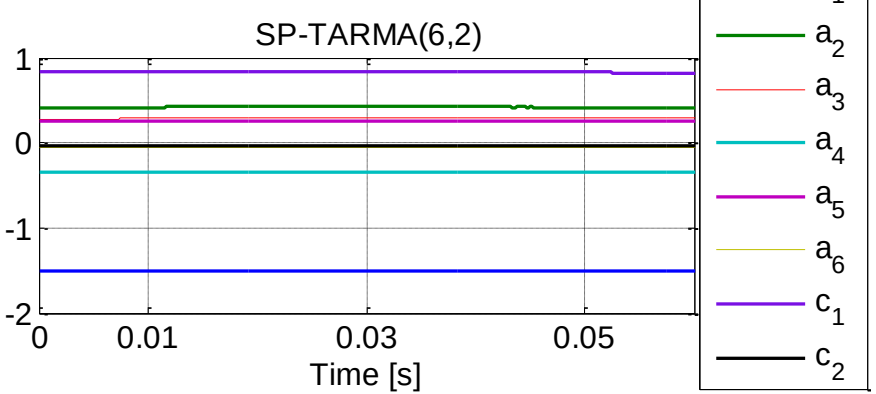
2. Methodology

SP-TARMA modeling









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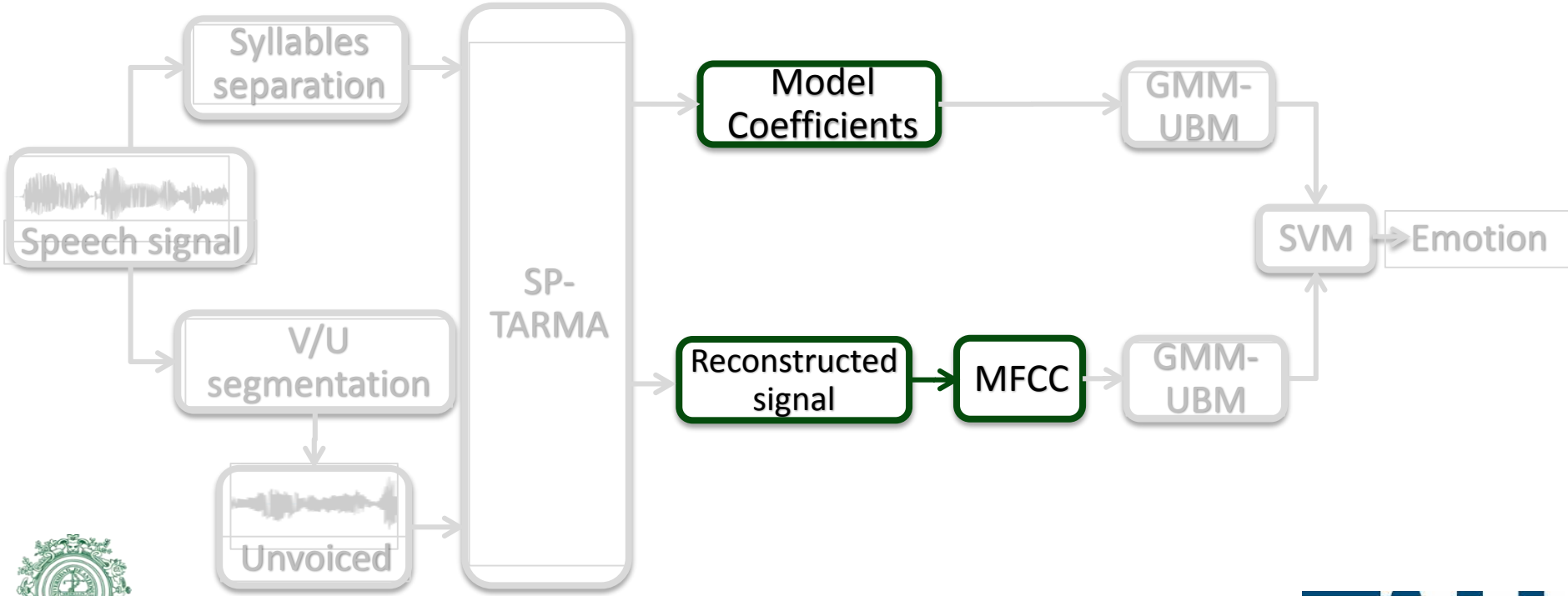
2. Methodology



2. Methodology

Characterization

Feature set 1

From model Coefficients:

- ✓Mean
- ✓Stadard deviation
- ✓Skewness
- ✓Kurtosis
- ✓Maximum
- ✓Minimum
- ✓Log-energy

Feature set 2

From reconstructed signal:

- ✓ 12 MFCC

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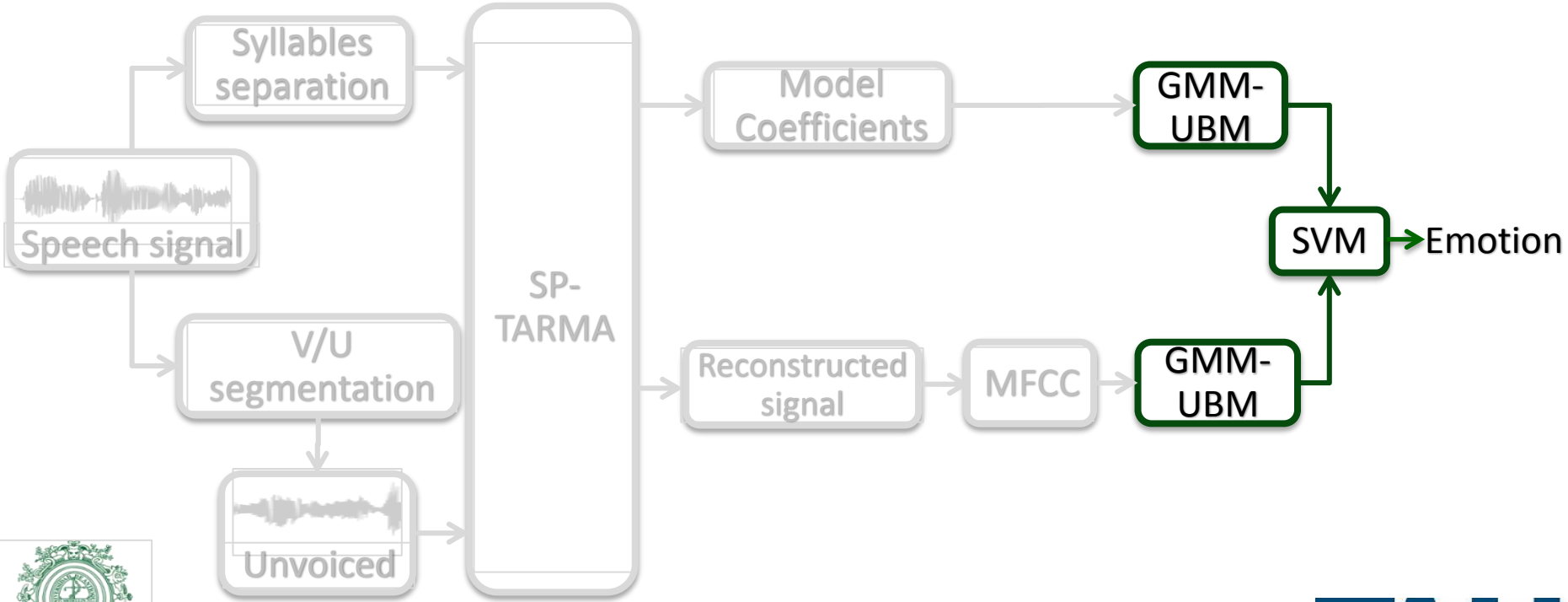
2. Methodology



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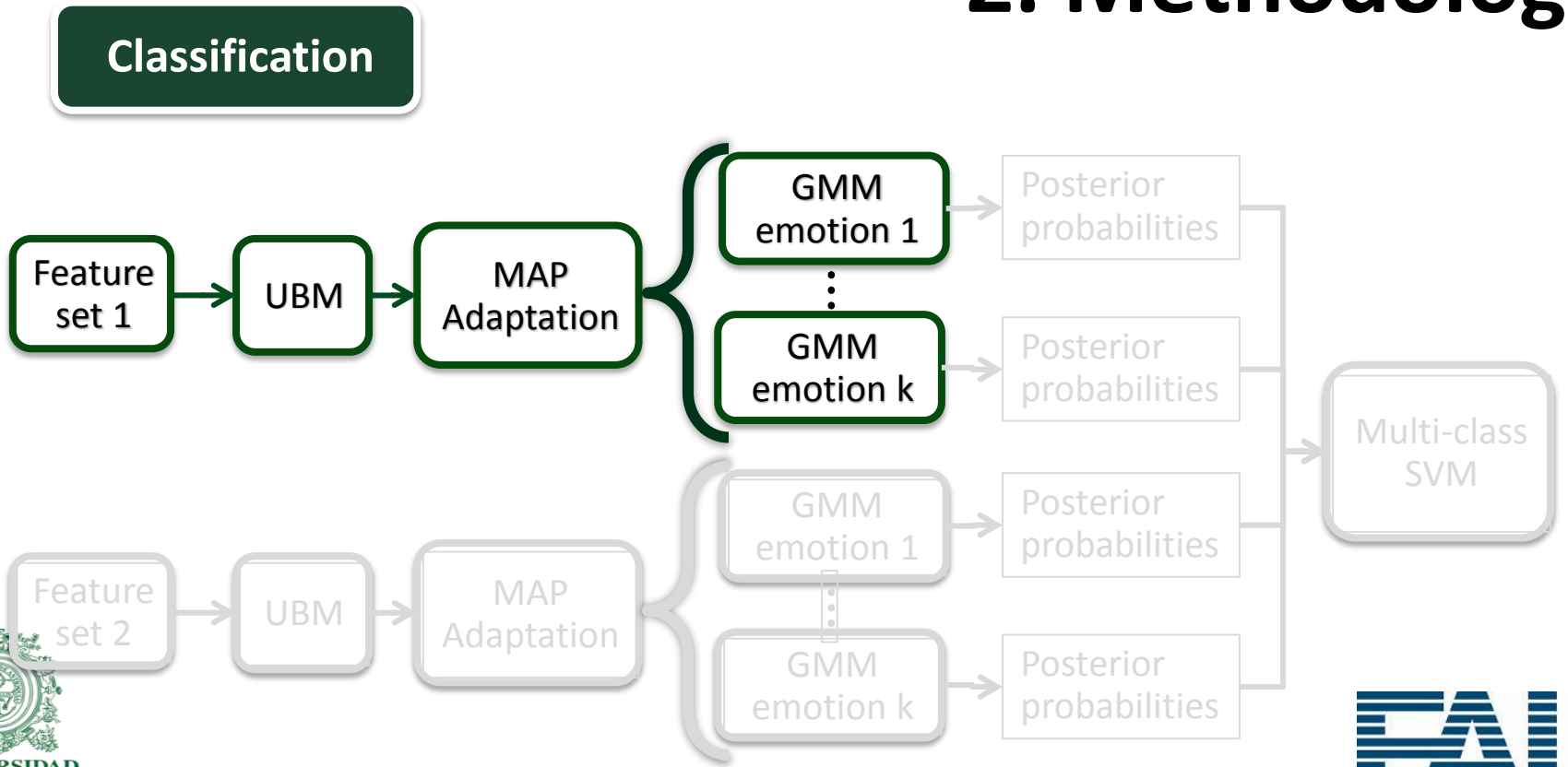

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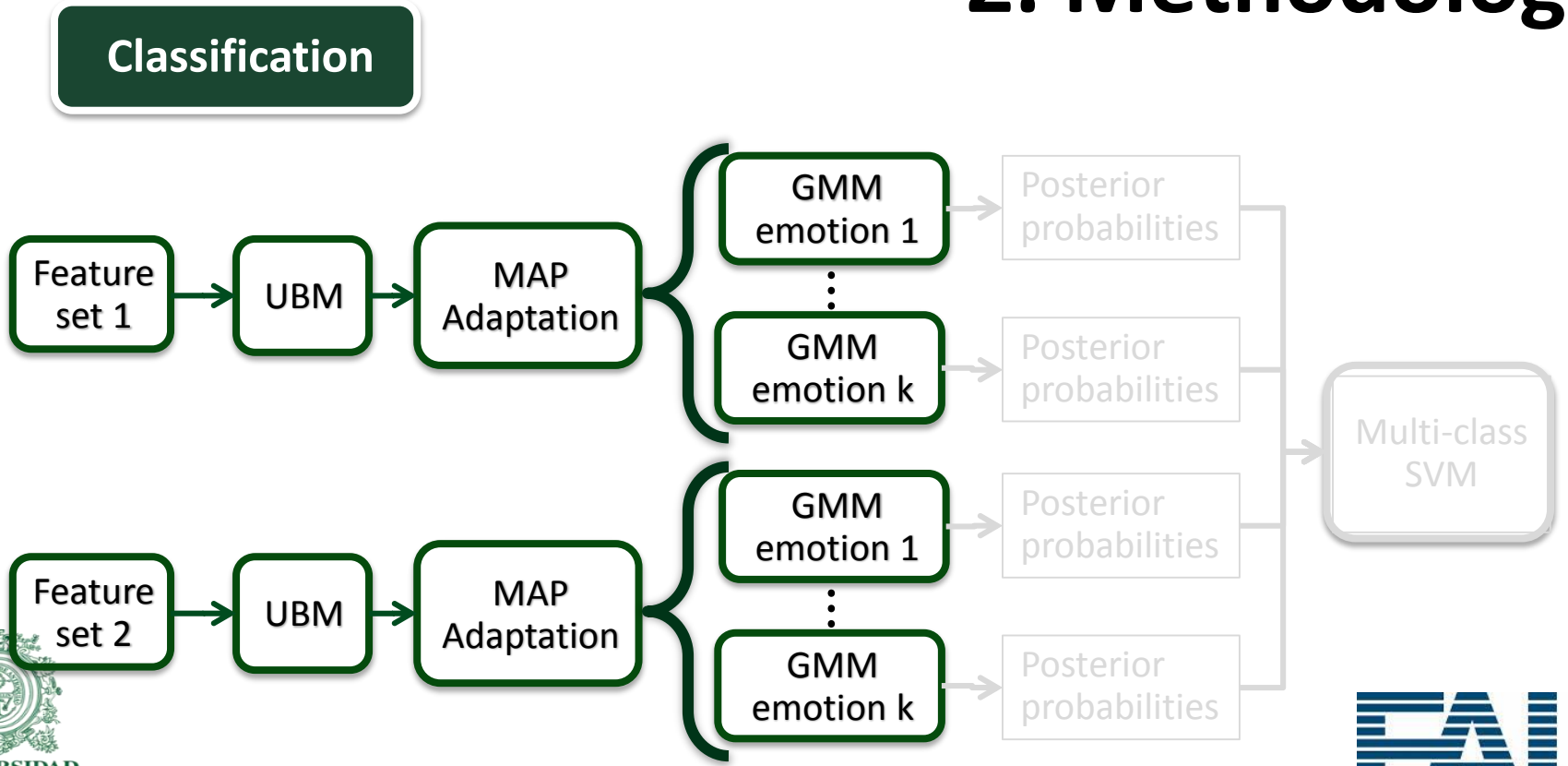

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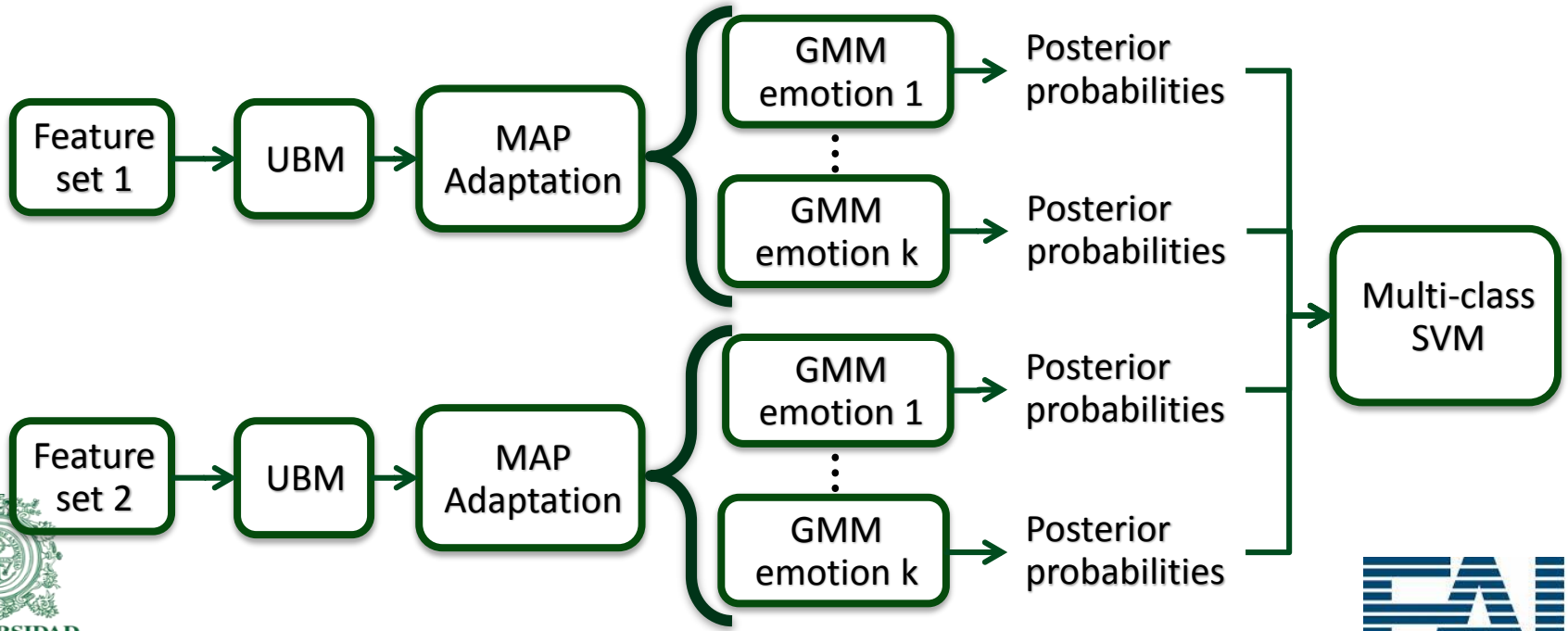
2. Methodology

Classification



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2. Methodology

Optimization parameters

- ✓ Leave One Speaker Out Cross-validation
- ✓ # of Gaussian components: 2-8
- ✓ Diagonal covariance matrix
- ✓ $10^{-1} < C < 10^{4}$
- ✓ $10^{-2} < \gamma < 10^{2}$

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3. Databases

Database	# recordings	# speakers	Sampling frequency
Berlin	534	10	16000 Hz
Enterface05	1317	44	44100 Hz

3. Experiments

Multi-class

Berlin DB

Enterface05 DB

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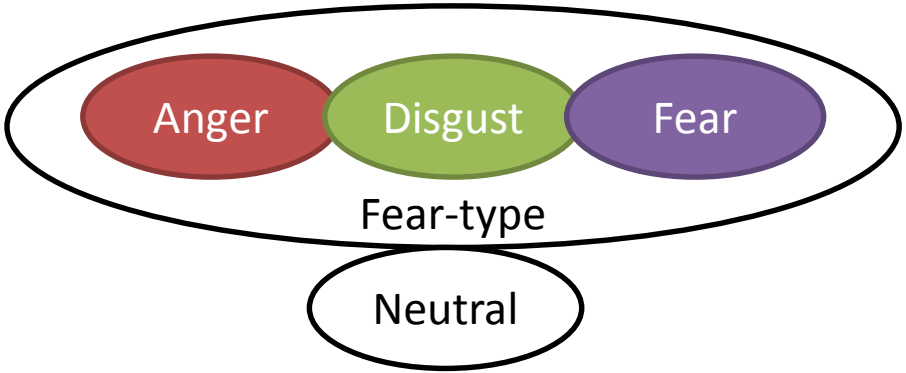
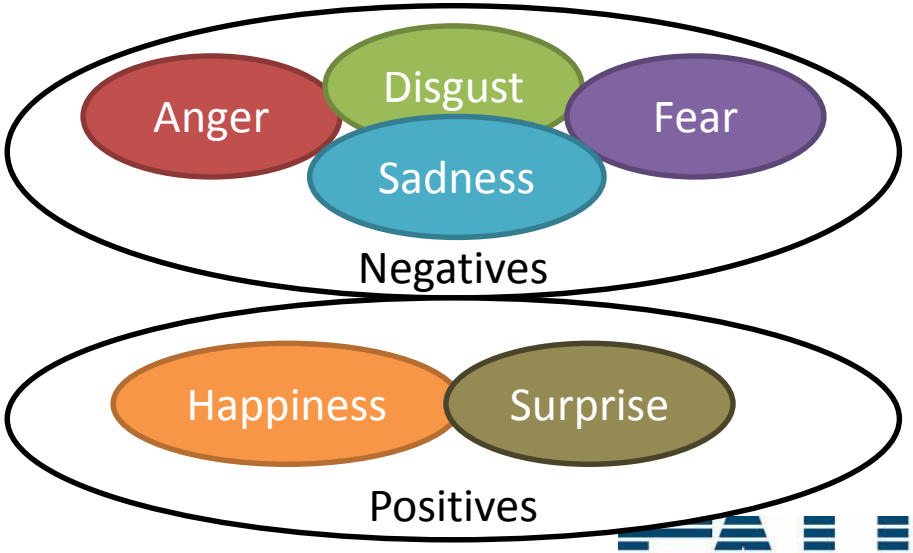
3. Experiments

2-class

Berlin DB



Enterface05 DB



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4. Results

Multi-class experiment

Feature Set	Berlin database		Enterface05 database	
	UV	Syllables	UV	Syllables
Feature set 1	62 ± 7	70 ± 9	40 ± 4	41 ± 6
Feature set 2	59 ± 11	78 ± 8	55 ± 5	59 ± 5
Multi-class SVM	65 ± 9	**82 ± 14**	55 ± 5	**60 ± 8**

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4. Results

Multi-class experiment

	Berlin Database			Enterface05 Database		
	Fear	Disgust	Anger	Fear	Disgust	Anger
Fear	**80.3**	10.1	8.9	**58.3**	16.2	16.8
Disgust	15.2	**76.7**	8.9	21.4	**59.8**	21.6
Anger	4.5	13.3	**82.2**	20.3	24.0	**61.6**

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4. Results

2-class Experiment

Feature Set	Frames	Berlin database			Enterface05 database		
		Acc	Sens	Spec	Acc	Sens	Spec
Feature set 1	UV	80.1	82.9	75.3	55.3	55.5	54.8
Feature set 2	UV	77.8	80.2	70.6	54.0	62.1	37.5
SVM-multi-class	UV	85.6	86.4	78.2	**68.2**	68.2	67.9
Feature set 1	Syll	84.2	85.0	78.2	56.0	60.9	46.2
Feature set 2	Syll	76.3	79.2	67.4	53.9	55.0	31.0
SVM-multi-class	Syll	**86.3**	86.9	81.5	67.9	68.2	63.6

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5. Conclusion

1. New method to characterize non-stationary process in speech.
2. Unvoiced and syllables are characterized.
3. Multi-class and 2-class experimets are considered

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5. Conclusion

4. The method is more suitable to characterize syllables instead of unvoiced frames in multi-class.

5. There is no significative diference in 2-class

6. The second classification provides an improvement in the general accuracy rate relative to the separately classification

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5. Conclusion

7. Features proposed could be used as complement to classical features for speech analysis.

8. More features from the TARMA should be analyzed

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Thanks!

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