Automatic Detection of Parkinson's Disease from Continuous Speech Recorded in Non-Controlled Noise Conditions

J.C. Vásquez-Correa[1], T. Arias-Vergara[1], J.R Orozco-Arroyave[1,2], J.F Vargas-Bonilla[1],
J.D Arias-Londoño[1], Elmar Nöth[2]

[1] Faculty of Engineering, University of Antioquia UdeA
[2] Pattern Recognition Lab, Friedrich Alexander Universität, Erlangen-Nürnberg
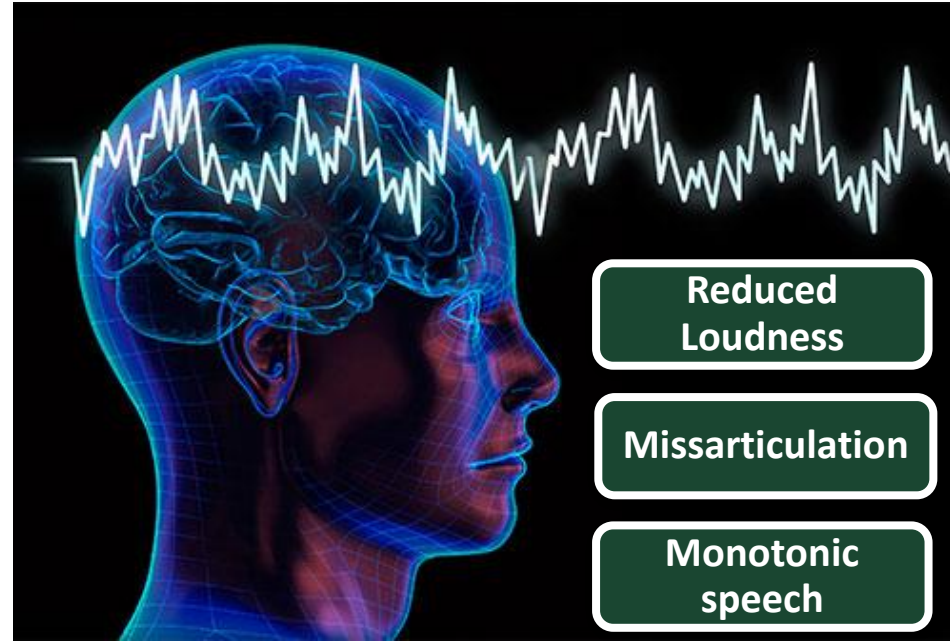
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Outline

1. **Introduction**
2. Methodology
3. Database
4. Device
5. Results
6. Conclusion

jcamilo.vasquez@udea.edu.co

1. Introduction

- ✓ Voice impairments appear in about 90% of people with Parkinson's diasease.

- ✓ Only from 3% to 4% of patients recieve speech therapy

Reduced Loudness

Missarticulation

Monotonic speech

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1. Introduction

- ✓ Intereset: Develop computer-aided tools to perform screenings from speech. The main aims are

    - ✓ Spare patients moving from home to the hospital

    - ✓ Raise early alerts to patient and doctors

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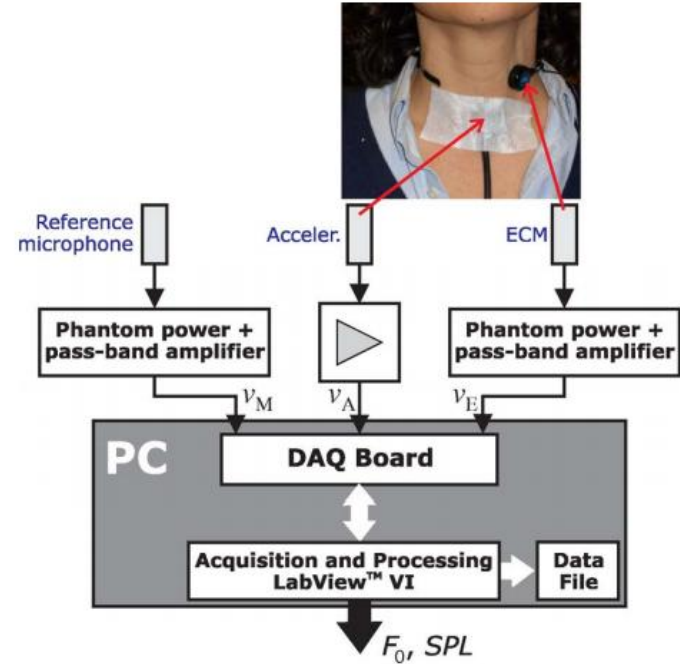# 1. Introduction

Currently

- ✓ The devices are mainly focused on the analysis of sustained phonations.

- ✓ The devices could be considered invasives.

- ✓ Methodologies are not adapted for evaluating speech recorded in non-controlled noise conditions.

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1. Introduction

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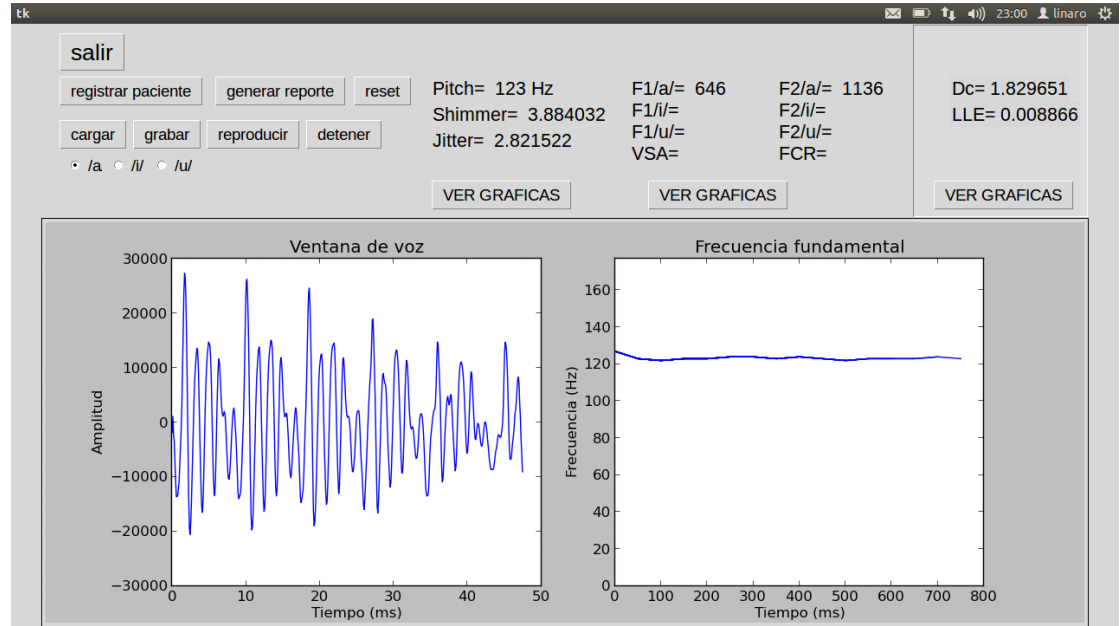
What is missing?

✓ Portable devices and tools for the analysis of speech of people wirth Parkinson's disease considering continuous speech signals recorded in non-controlled noise conditions.

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1. Introduction

Aims

✓ Portable device for recording and analysis of speech of patients

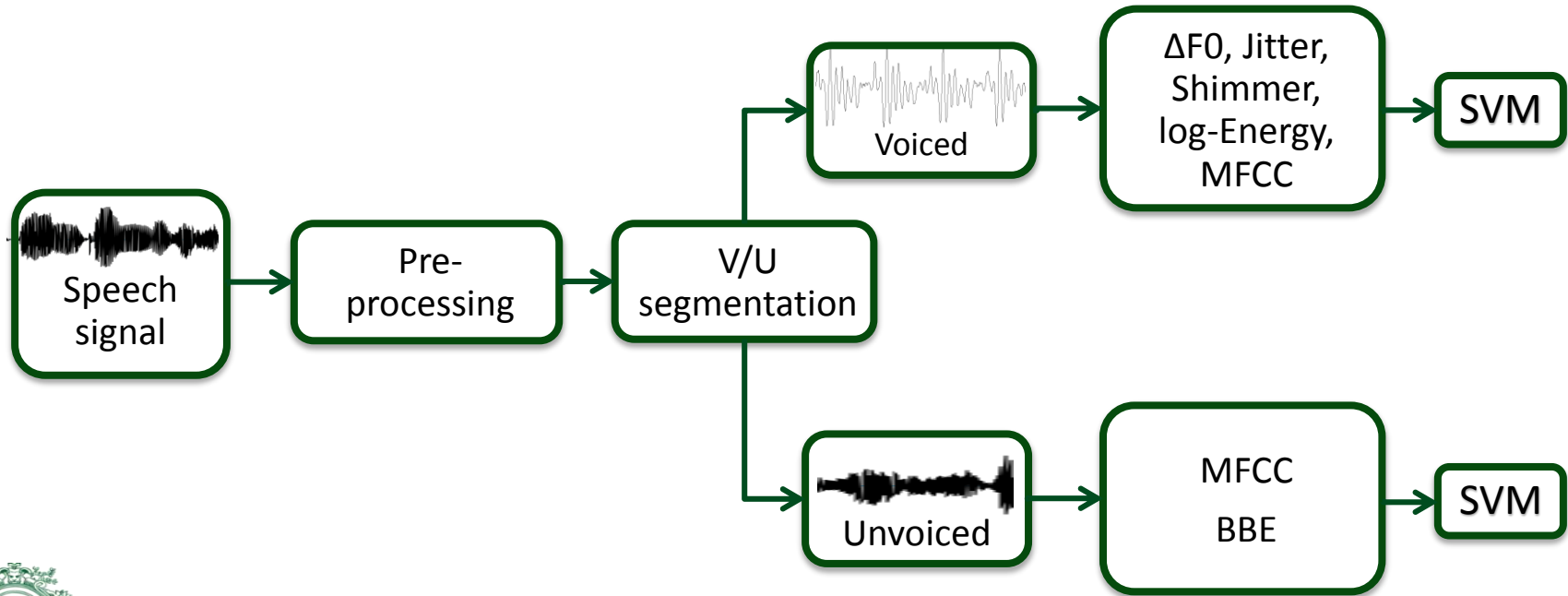✓ Evaluation of methodology in non-controlled noise conditions.

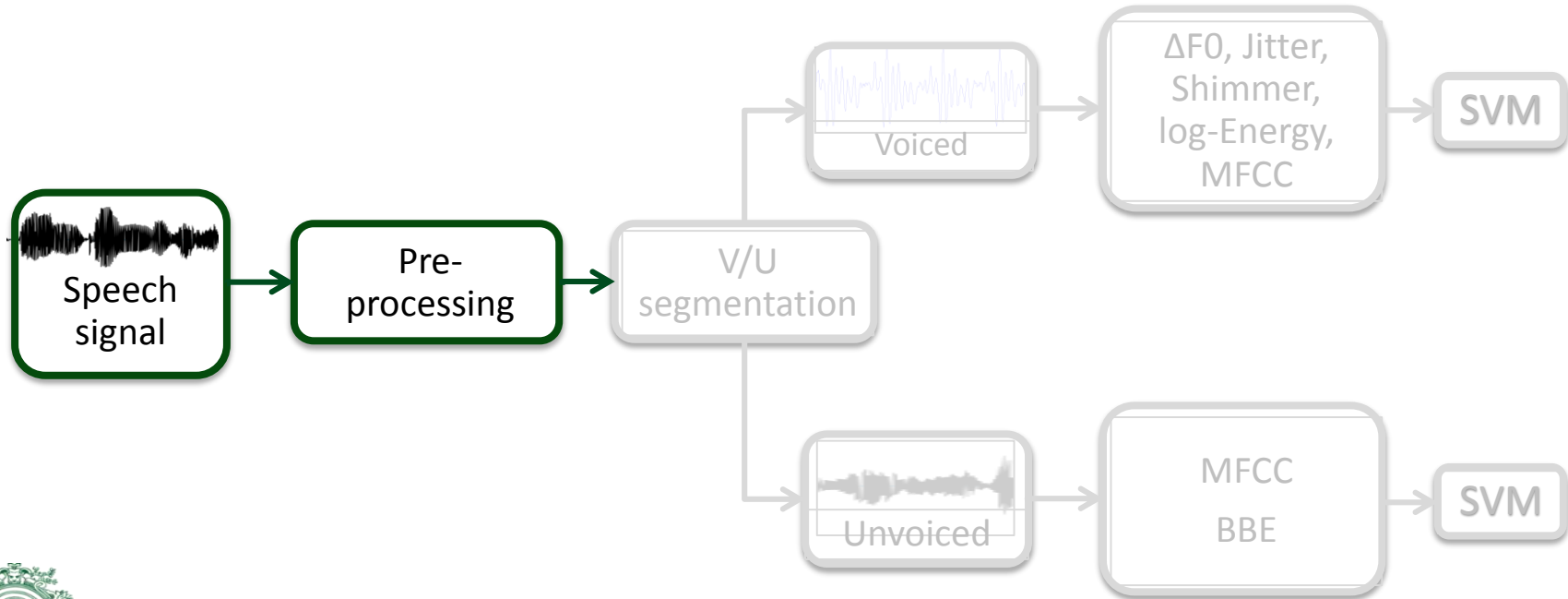UNIVERSIDAD
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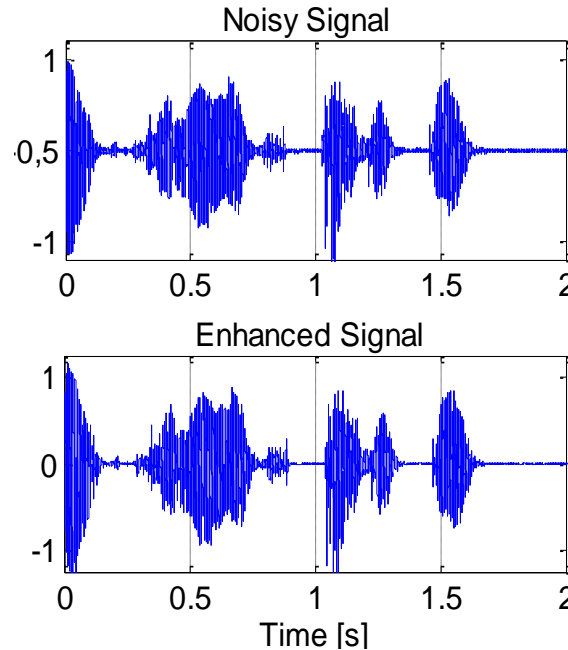
2. Methodology

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Pre-processing

✓ Speech enhancement

✓ Mean cepstral subtraction

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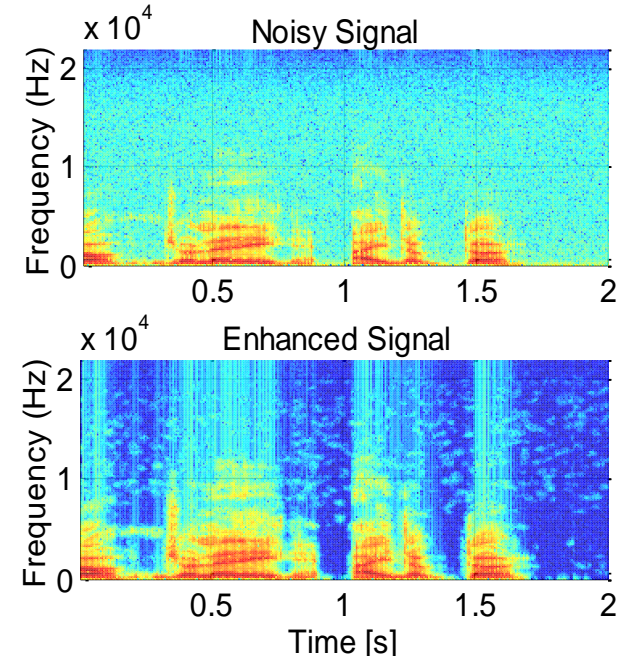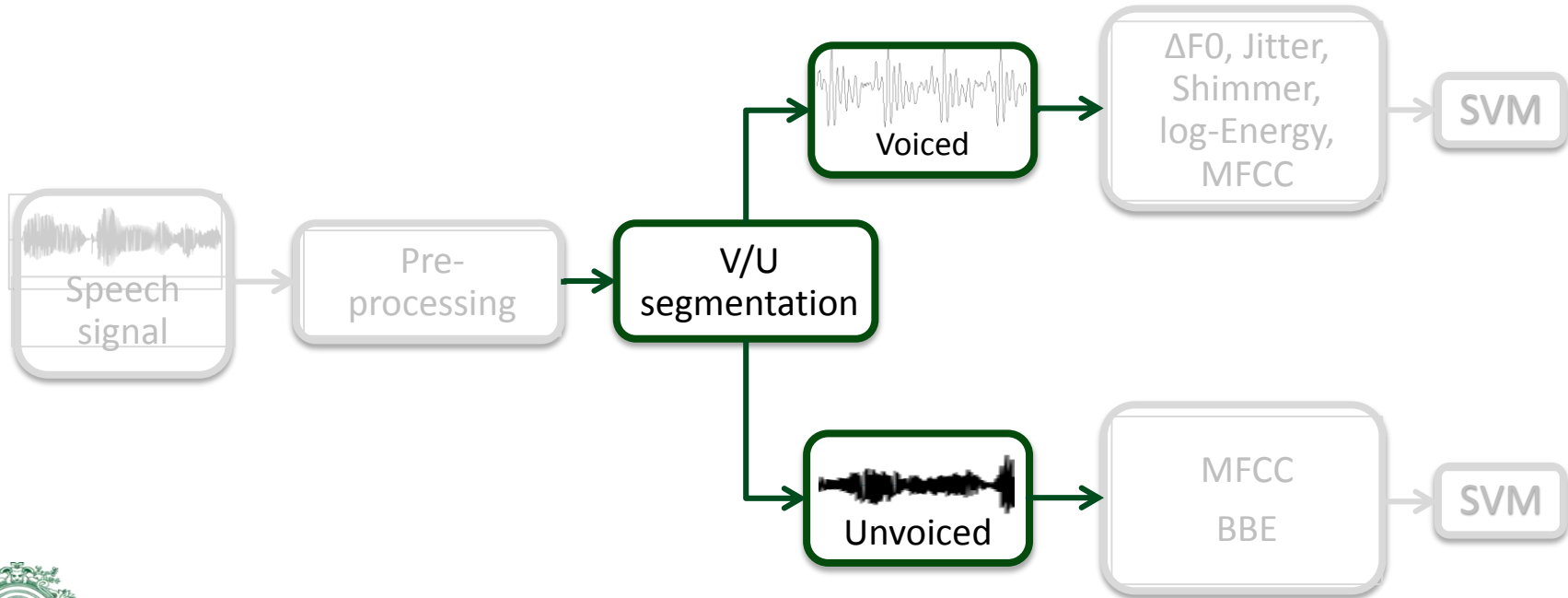
Segmentation

Two types of sound:

- ✓ Voiced
- ✓ Unvoiced

Both kind of segments are processed independently

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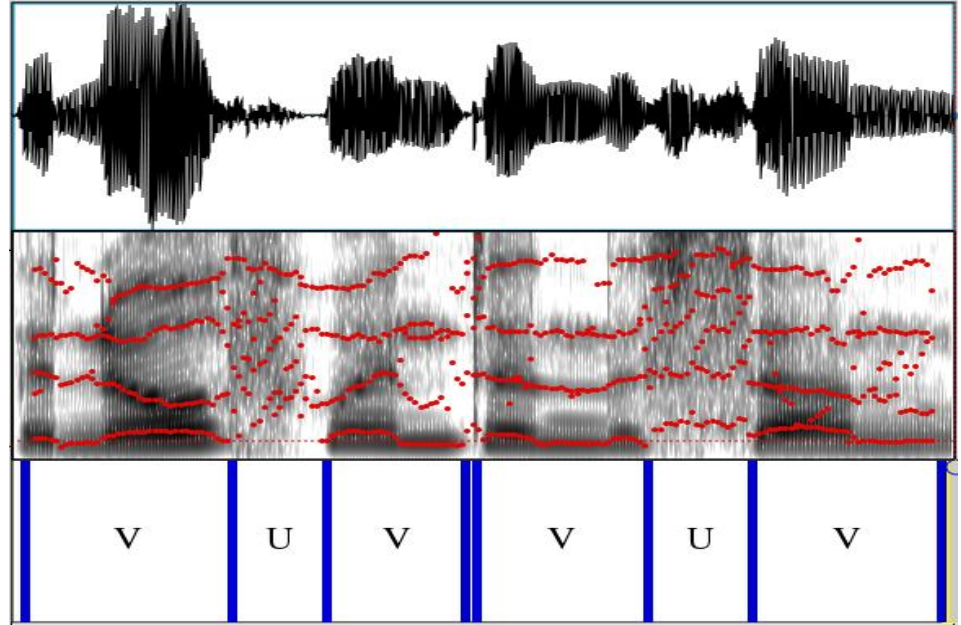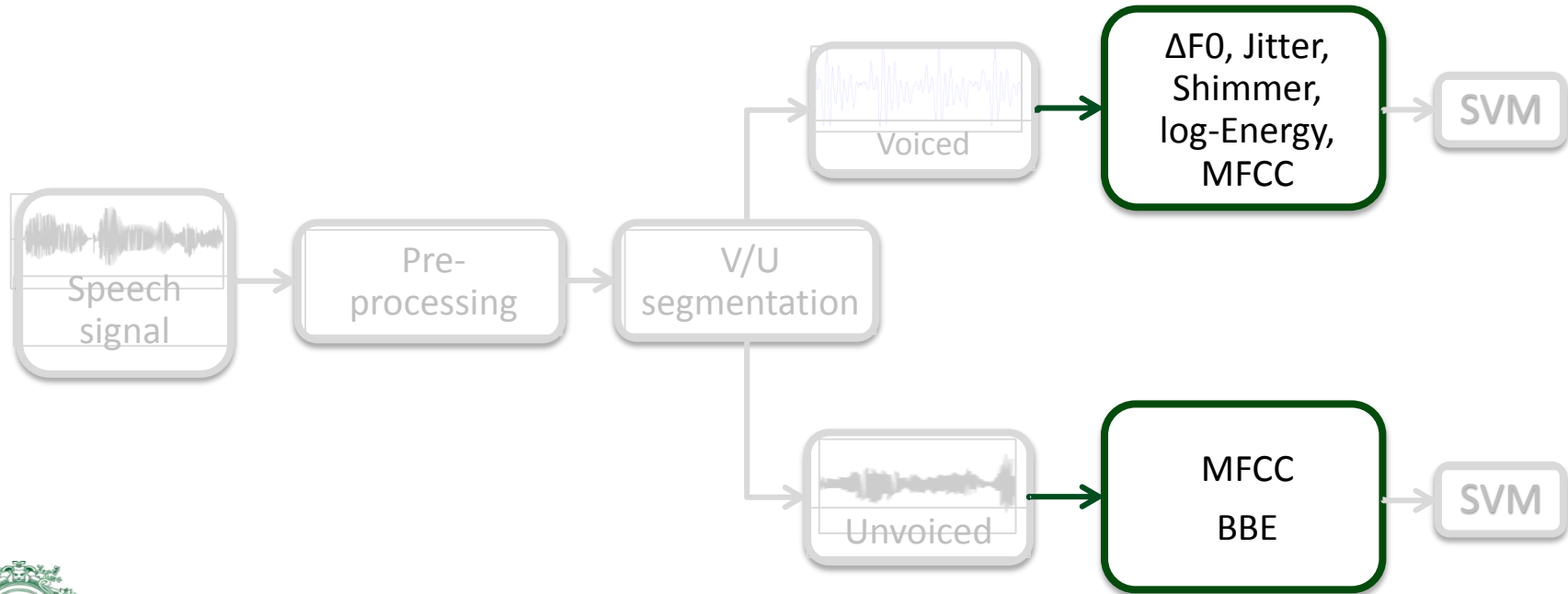
Characterization

Features Voiced Segments

- ✓ ΔF0
- ✓ Jitter
- ✓ Shimmer
- ✓ log-Energy
- ✓ 12 MFCC

Features Unvoiced Segments

- ✓ 12 MFCC
- ✓ 25 Energy coefficients acccording to Bark scale

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Characterization

20 ms length

Time-shift of 10 ms

mean,
standard deviation,
skewness,
kurtosis

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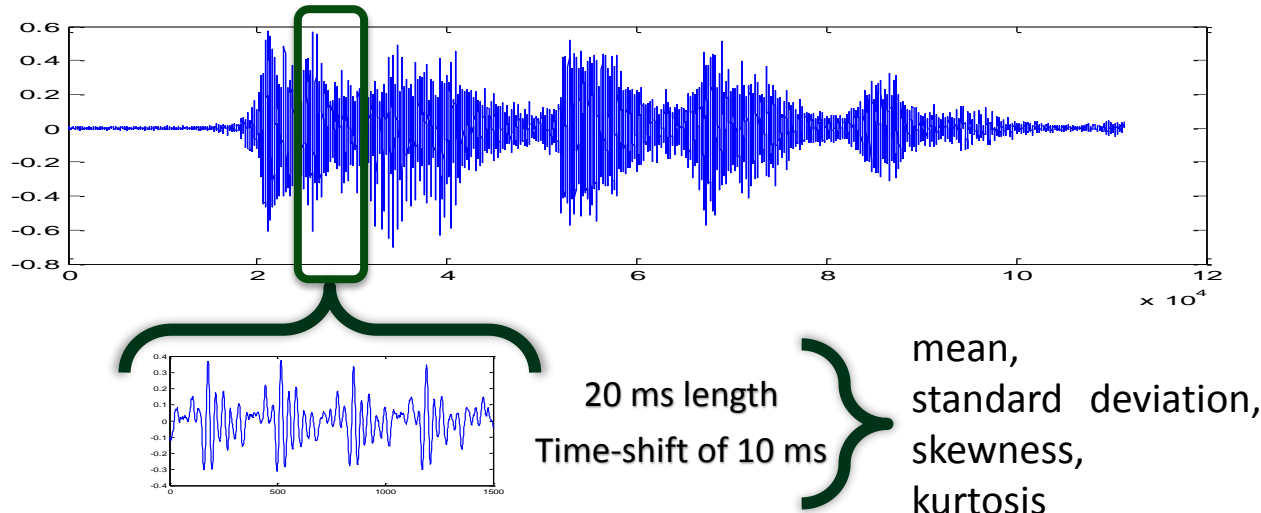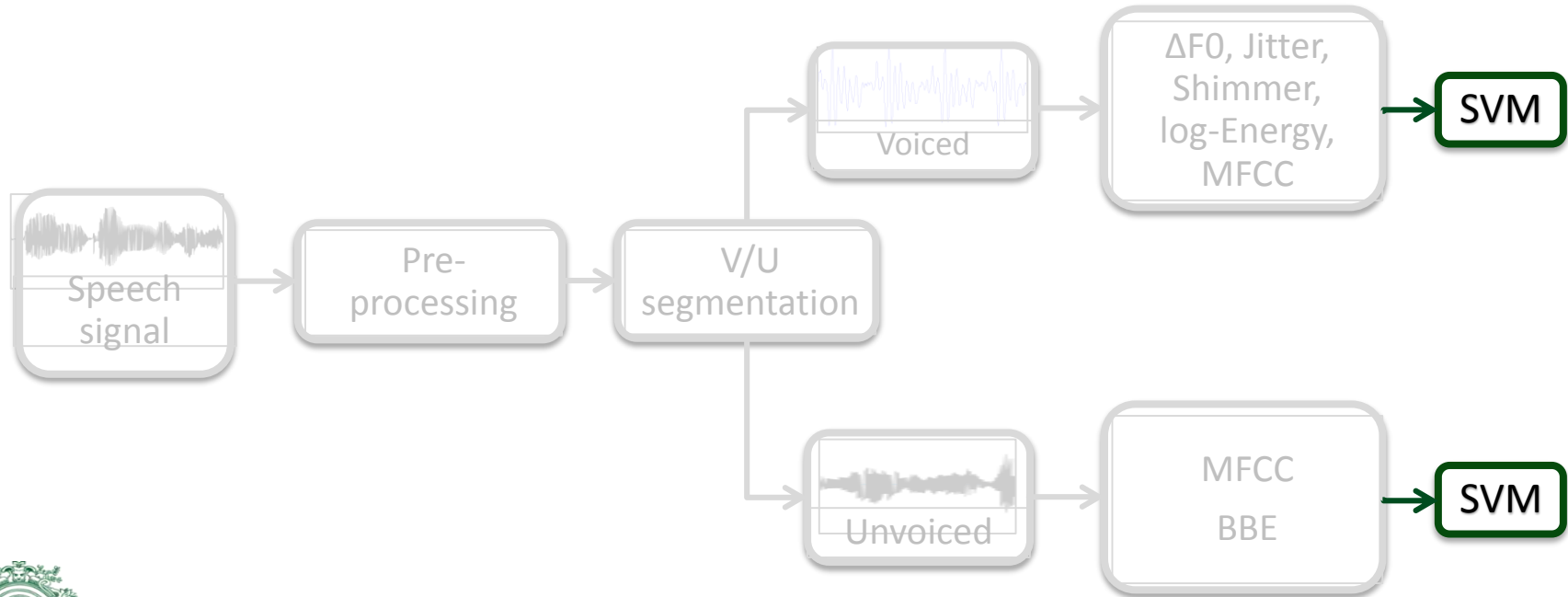
Classification

✓ Gaussian kernel SVM.

✓ Parameters of the SVM are optimized in a range:

    ✓ *$10^{-1} < C < 10^{4}$*

    ✓ *$10^{-2} < \gamma < 10^{2}$*

✓ Leave One Speaker Out (LOSO) Cross-validation

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3. Database

	Patients with Parkinson's disease	Healthy controls
Num recordings	14	14
Age	Mean 61.64 ± 6.43	Mean 63.29 ± 10.43
Gender	7 male, 7 female	7 male, 7 female
Sampling frequency	44100 Hz	
Quantization bits	16	

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3. Database

✓ Six different sentences

✓ One read text with 36 words

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Recording Device

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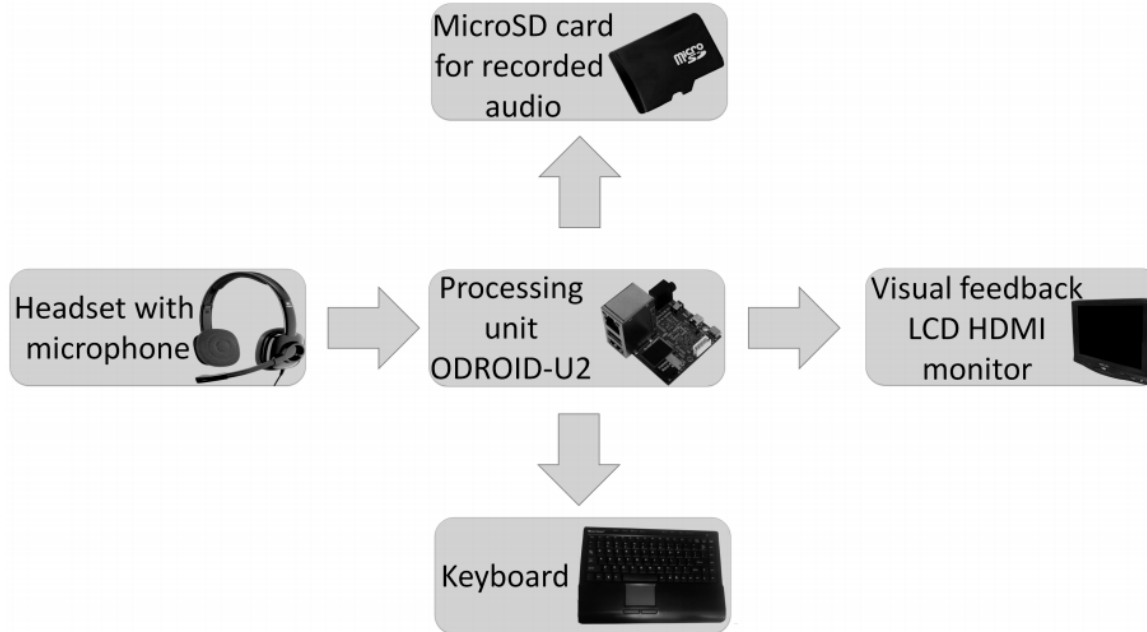
Voiced segments

Sentence	Accuracy (%)	
	Noisy	Enhanced
1	71 ± 26	82 ± 25
2	75 ± 26	64 ± 36
3	71 ± 26	79 ± 25
4	86 ± 31	79 ± 25
5	79 ± 25	82 ± 25
6	86 ± 23	75 ± 26
Read text	79 ± 25	71 ± 26

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4. Results

Unvoiced segments

Sentence	Accuracy (%)	
	Noisy	Enhanced
1	92 ± 19	93 ± 17
2	94 ± 15	91 ± 20
3	86 ± 23	97 ± 12
4	93 ± 18	94 ± 16
5	78 ± 25	90 ± 20
6	86 ± 23	97 ± 12
Read text	99 ± 3	99 ± 1

Unvoiced segments

Sentence	Accuracy (%)	
	Noisy	Enhanced
1	92 ± 19	93 ± 17
2	94 ± 15	91 ± 20
3	86 ± 23	97 ± 12
4	93 ± 18	94 ± 16
5	78 ± 25	90 ± 20
6	86 ± 23	97 ± 12
Read text	99 ± 3	99 ± 1

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4. Results

Voiced frames Sentence 6
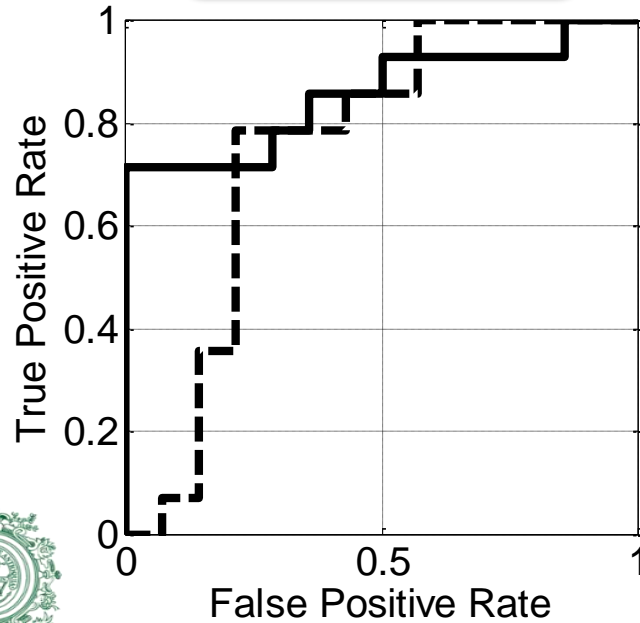
Unvoiced frames Sentence 6
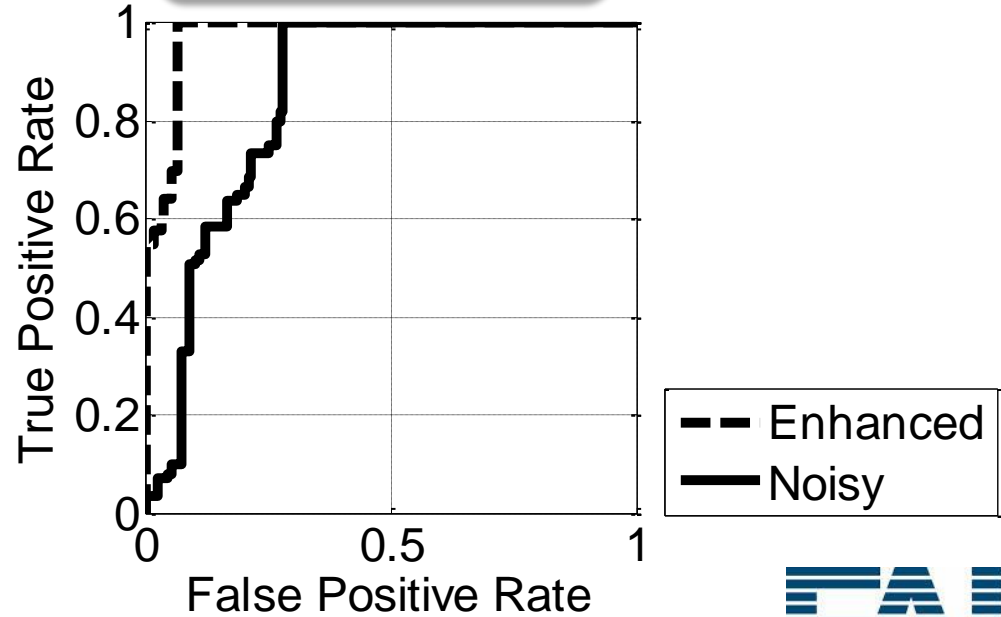
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5. Conclusion

1. A computational tool is presented for the recording and analysis of speech with Parkinson's disease

2. The methodology evaluated considers speech recorded in non-controlled noise conditions.

3. It is useful the speech enhancement technique?

5. Conclusion

4. The incorporation to the methodology of prosody features derived from timing, duration, and speech rate is planned for the near future.

5. The use of the computer tool to follow the speech therapy of the patients, and to asses their neurological state is also expected in the future.

jcamilo.vasquez@udea.edu.co

Thanks!

jcamilo.vasquez@udea.edu.co