Word recognition

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POLYTECH
NICE-SOPHIA

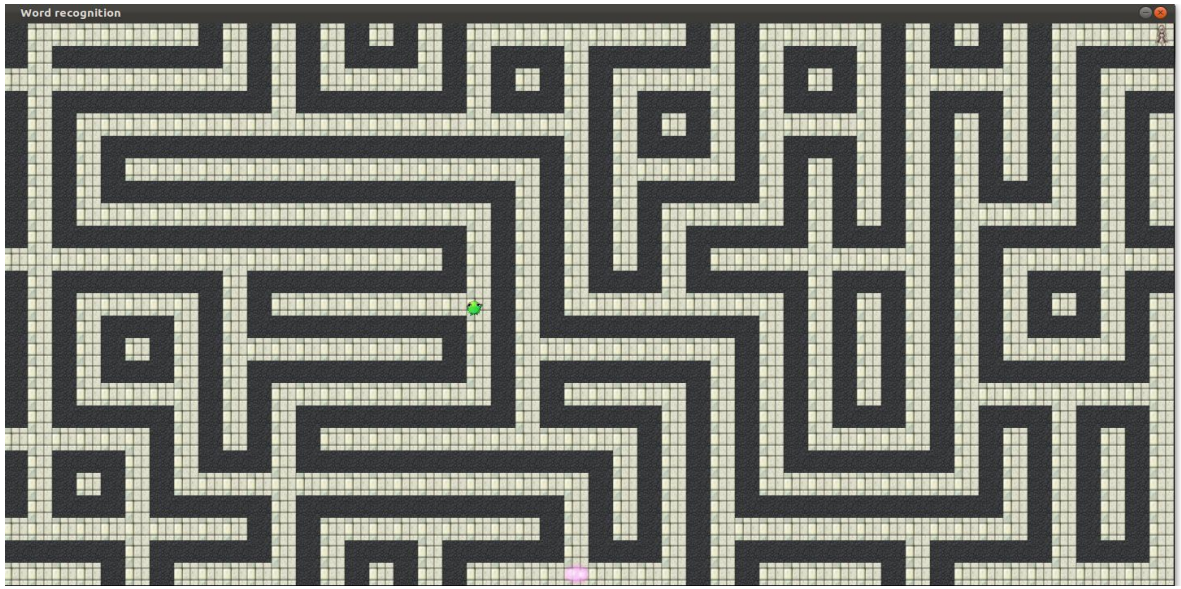
MAM4 G1

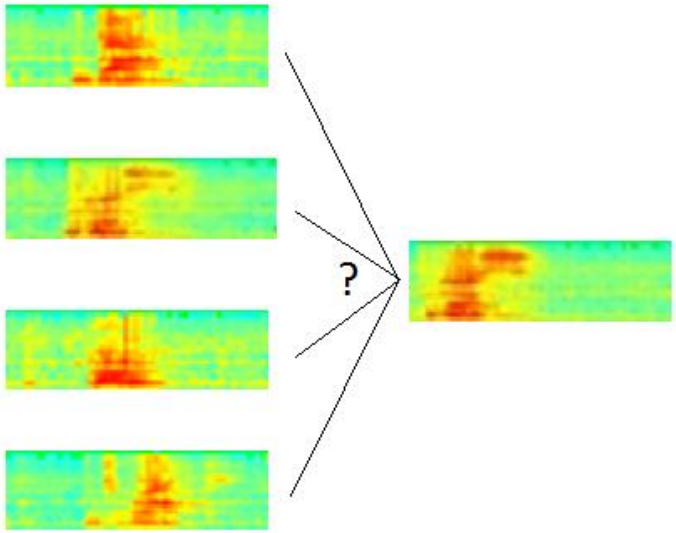
Introduction

- Home automation system
- Disable persons
- Games

Introduction

- Game by voice control





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Contents

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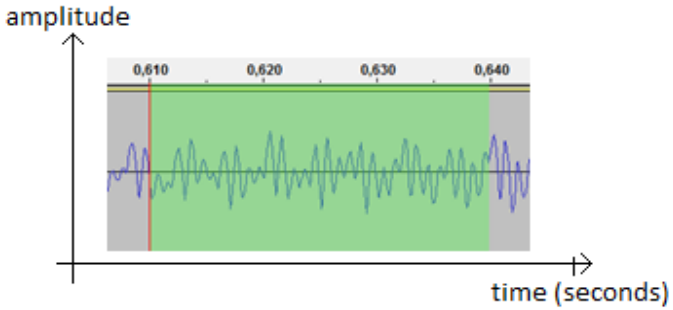
Sound treatment

- Sound recording
- Time split
- Treatment of each slice



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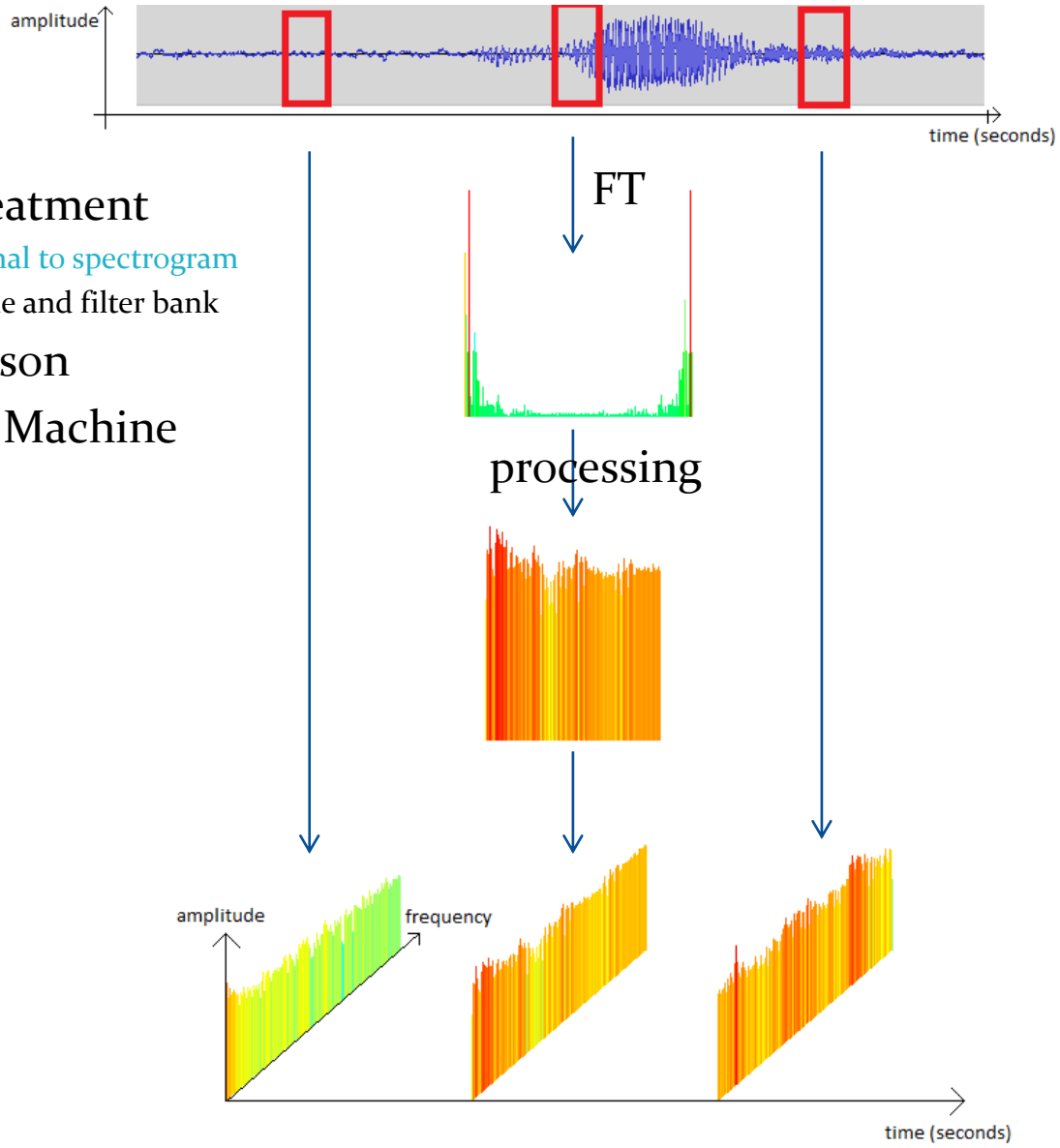
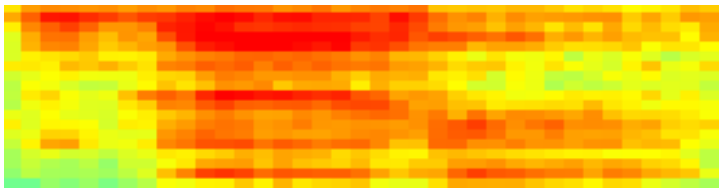
From signal to spectrogram



I. Sound treatment
   a. From signal to spectrogram
   b. Mel's scale and filter bank
II. Comparison
III. Human Machine Interface

Spectrogram

- 2D view spectrogram



« gauche »

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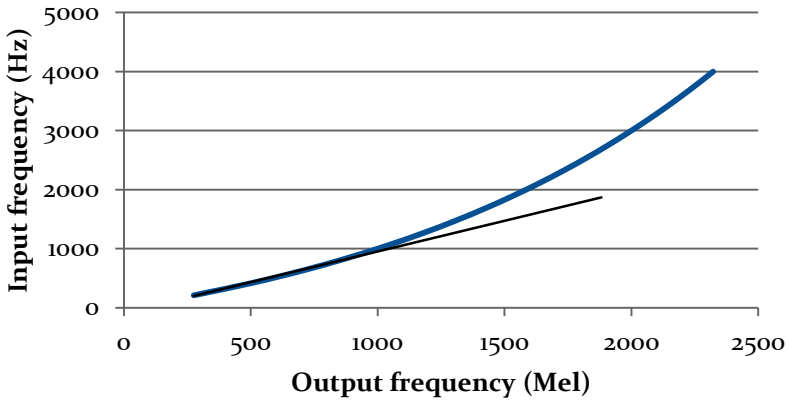
Mel's scale and filter bank

- Mel's scale:
  - Reduce the importance of high frequencies
  - From Hz to Mel

Mel's scale



$$M = \frac{1000}{\log(2)} * \log\left(1 + \frac{F}{1000}\right)$$

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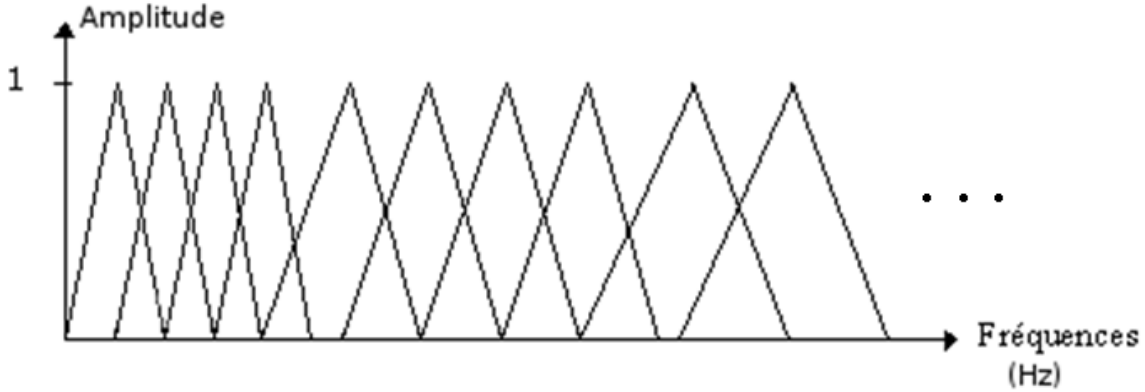
Mel's scale and filter bank

- Filter bank:
  - Reduce the number of frequencies considered
  - Uniform on the Mel's scale, non uniformly on the frequency scale



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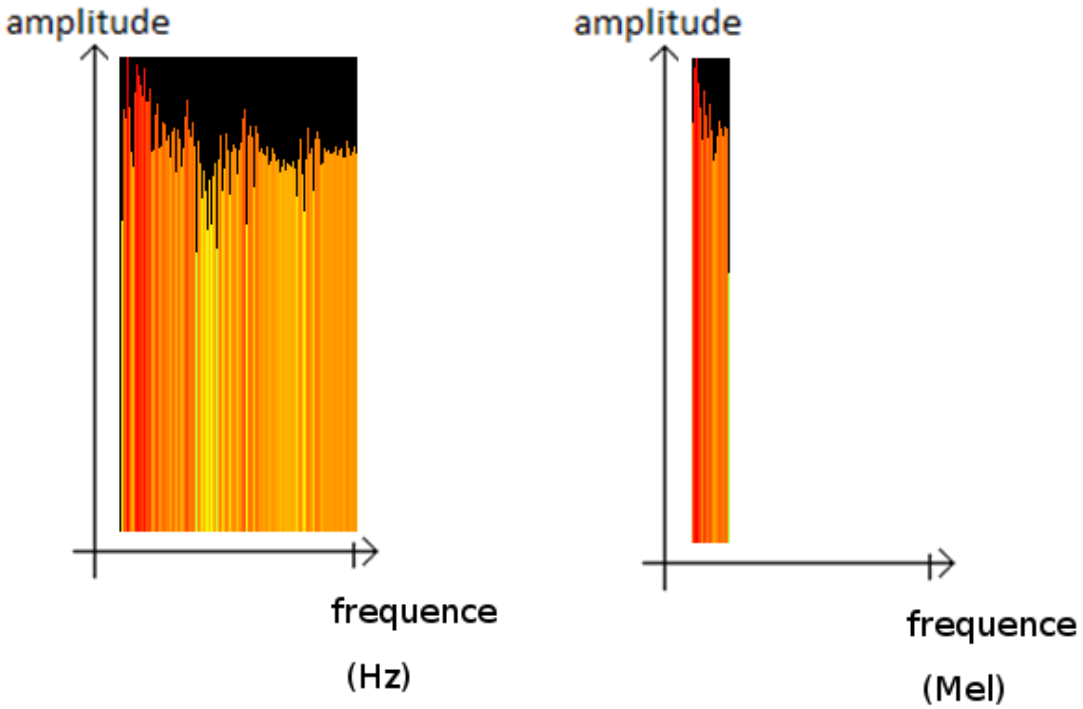
Mel's scale and filter bank

- Example:



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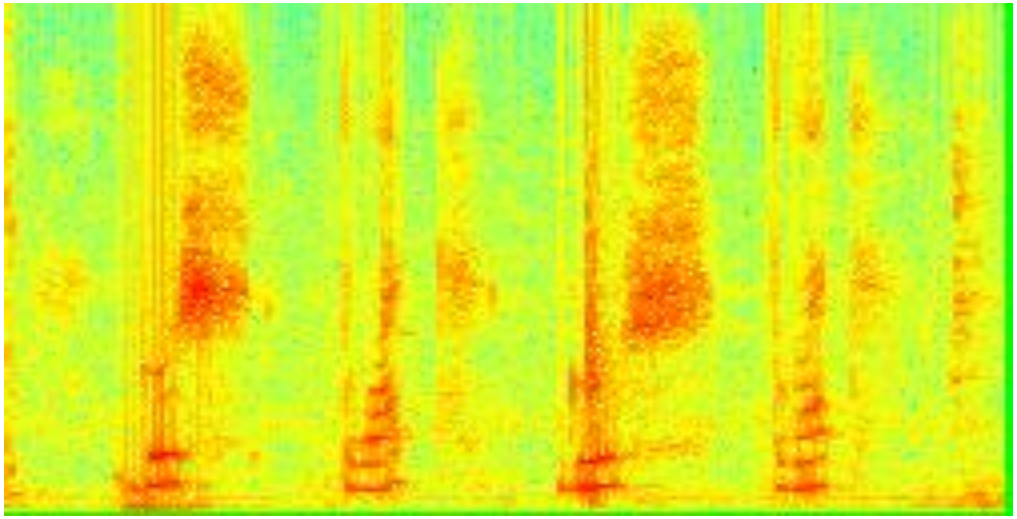
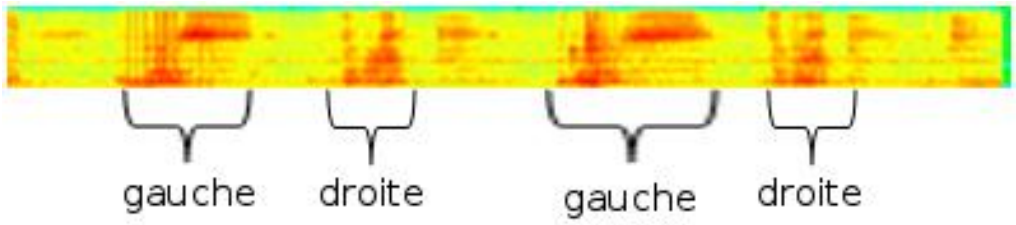
Mel's scale and filter bank





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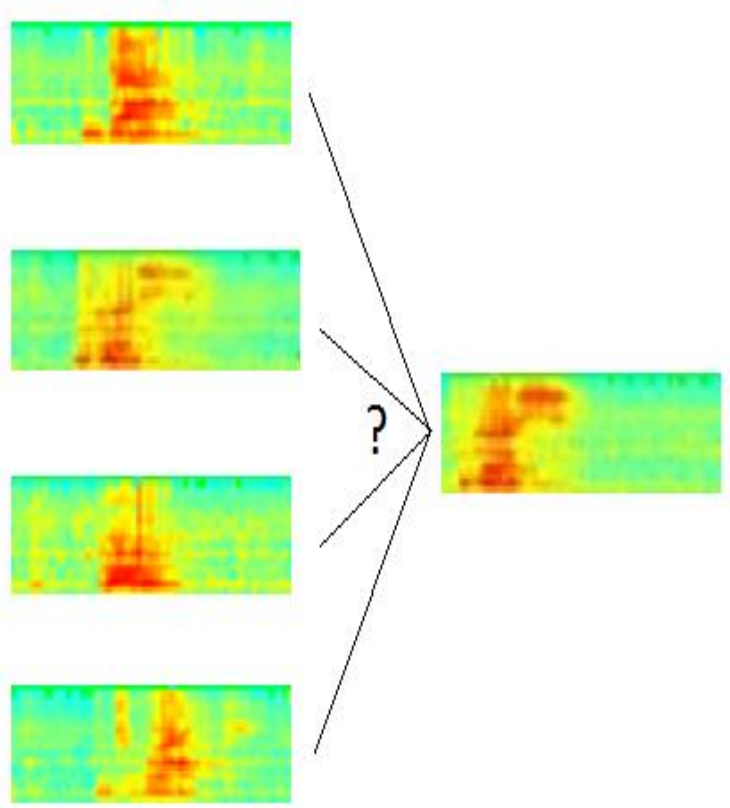
Comparison

- “Bas”
- “Gauche”
- “Haut”
- “Droite”



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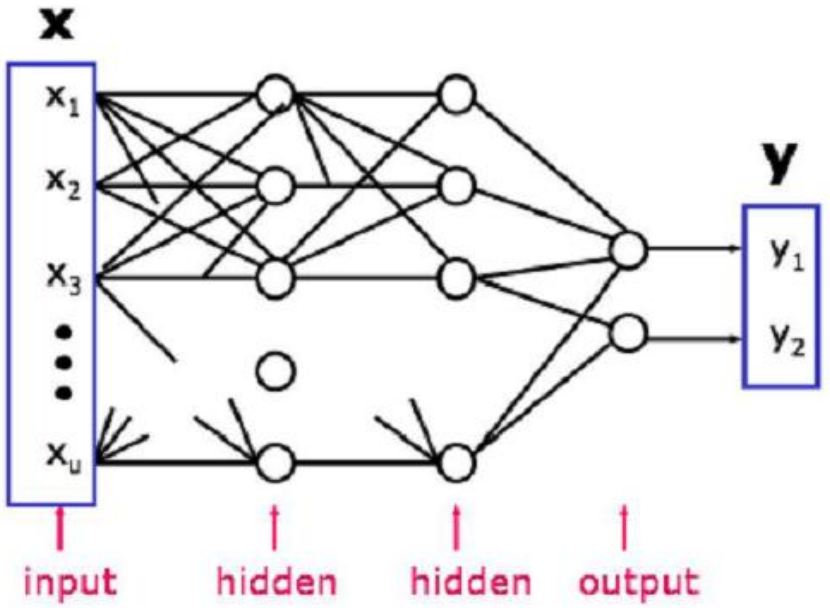
Existing methods

- Artificial neuronal networks:



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Existing methods

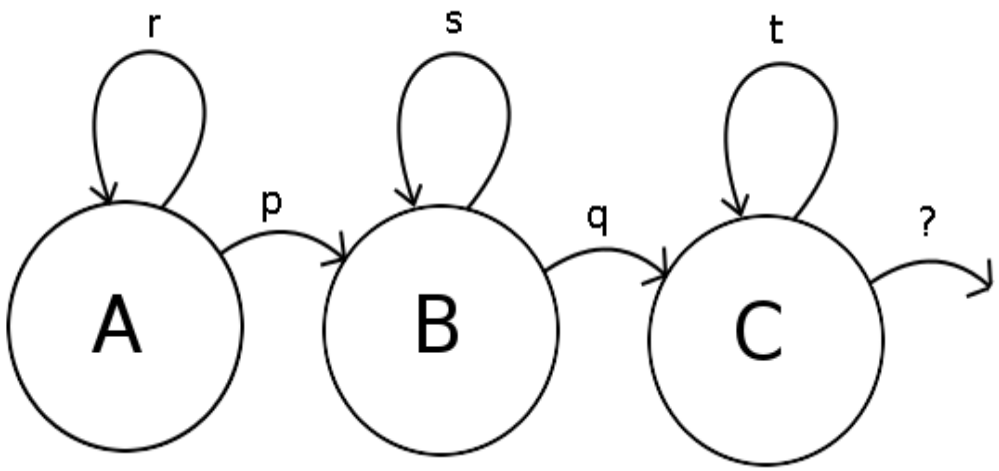
I. Sound treatment

II. Comparison

- a. Existing methods
- b. Dynamic Time Warping
- c. Method amelioration
- d. Results

III. Human Machine Interface

- Hidden Markov model



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Dynamic Time Warping

I. Sound treatment

II. Comparison

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- b. Dynamic Time Warping
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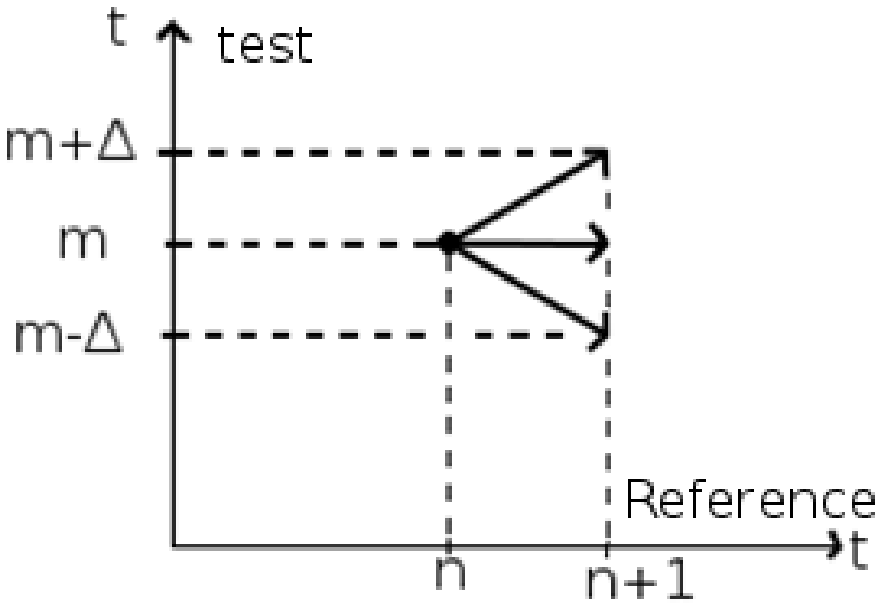
- d. Results

III. Human Machine Interface



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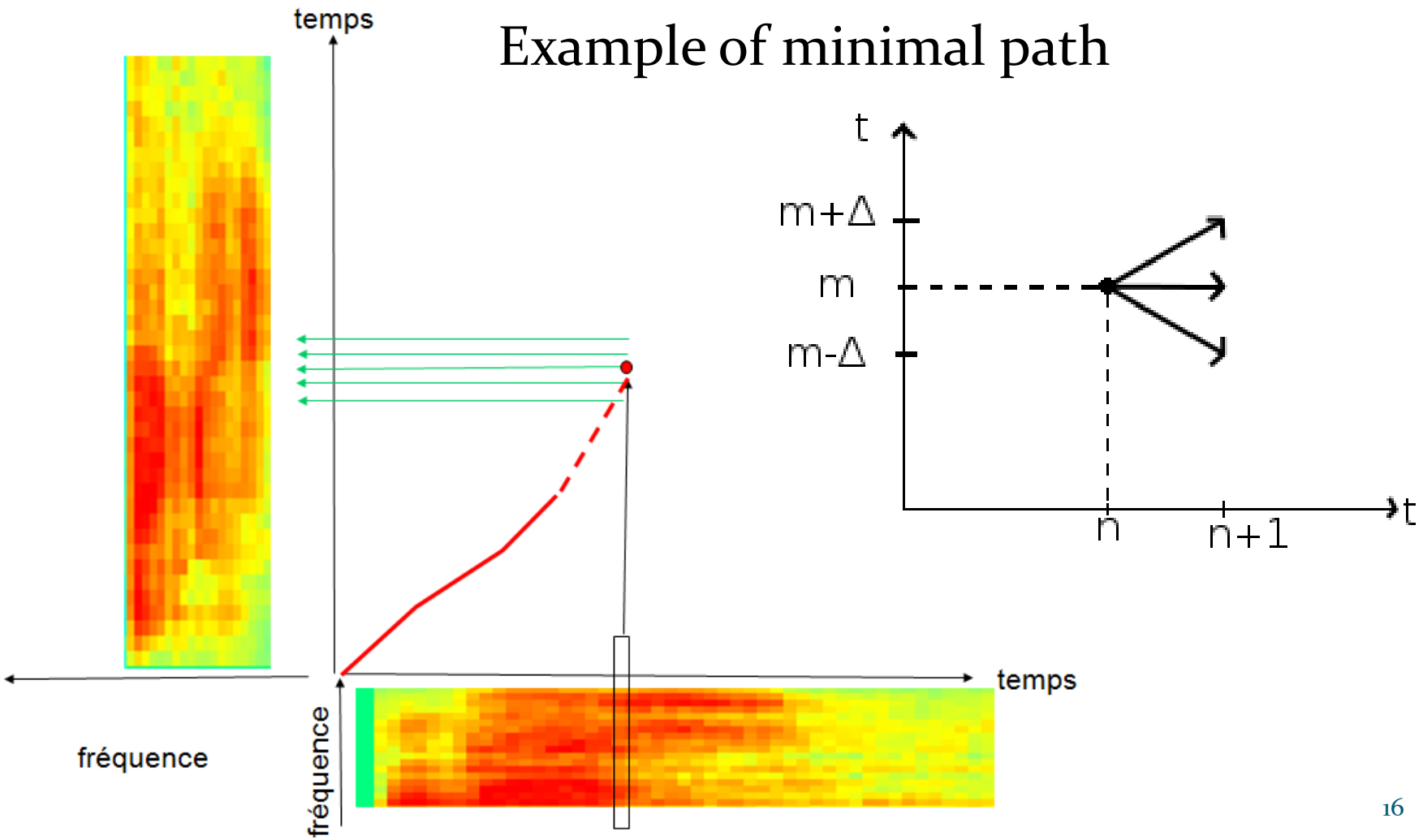
Dynamic Time Warping



Dynamic Time Warping

I. Sound treatment

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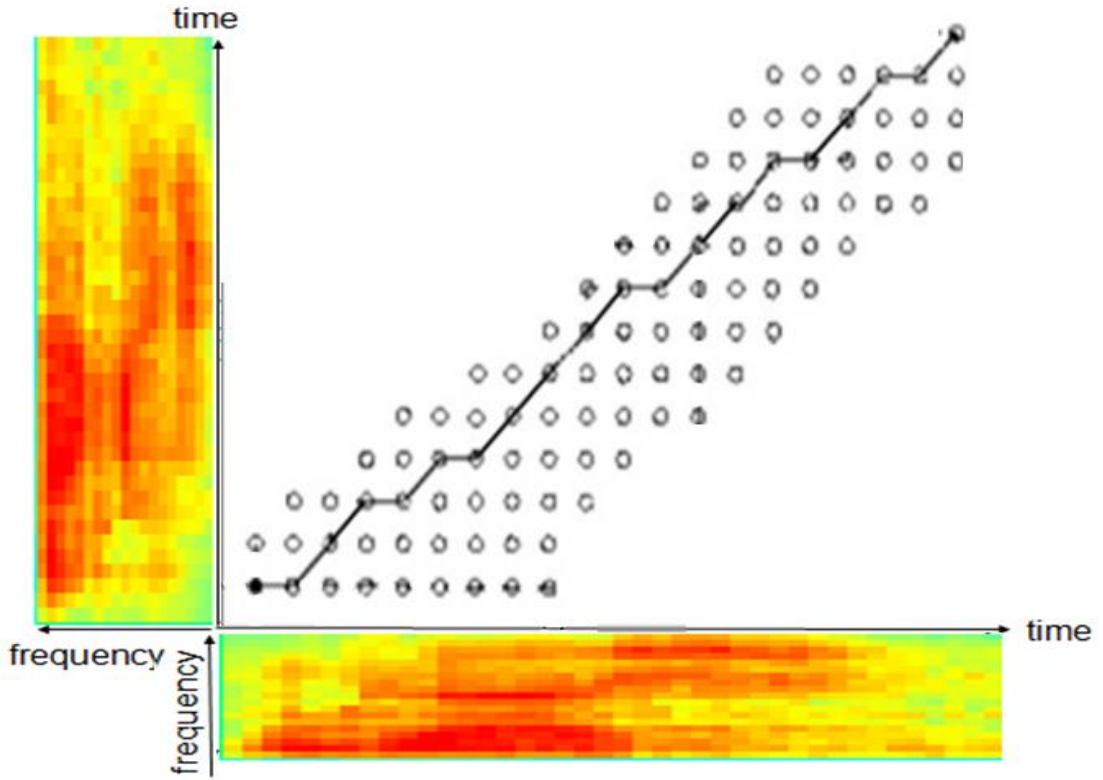
III. Human Machine Interface

Example of minimal path



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Dynamic Time Warping

- Limits:
  - Euclidean distance
  - Slower for big vocabularies
  - Word width

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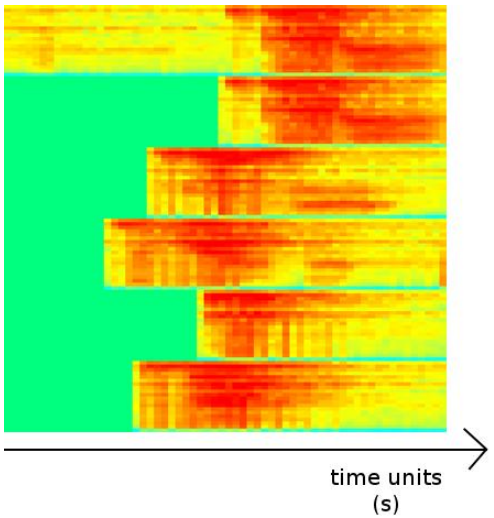
Method amelioration

- DTW parameters modifications
- Word beginning detection



- Global approach on DTW

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Results

- Local DTW
- Median DTW
- Global DTW

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Results

I. Sound treatment

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a. Existing methods

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III. Human Machine Interface

Words / Method ...	"gauche", "droite", "haut", "bas"	"Bonjour", "Hello", "Maison", "Placard"	"vacherin", "tiramisu", "moelleux", "bûche"	"Riri", "Fifi", "Loulou", "toto"
DTW local	62,5%	80%	70%	70%
DTW local and beginning detection	62,5%	80%	70%	70%
DTW median and beginning detection	85%	85%	98%	65%
DTW global and beginning detection	95%	90%	98%	85%

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Human Machine Interface

I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play

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Menu

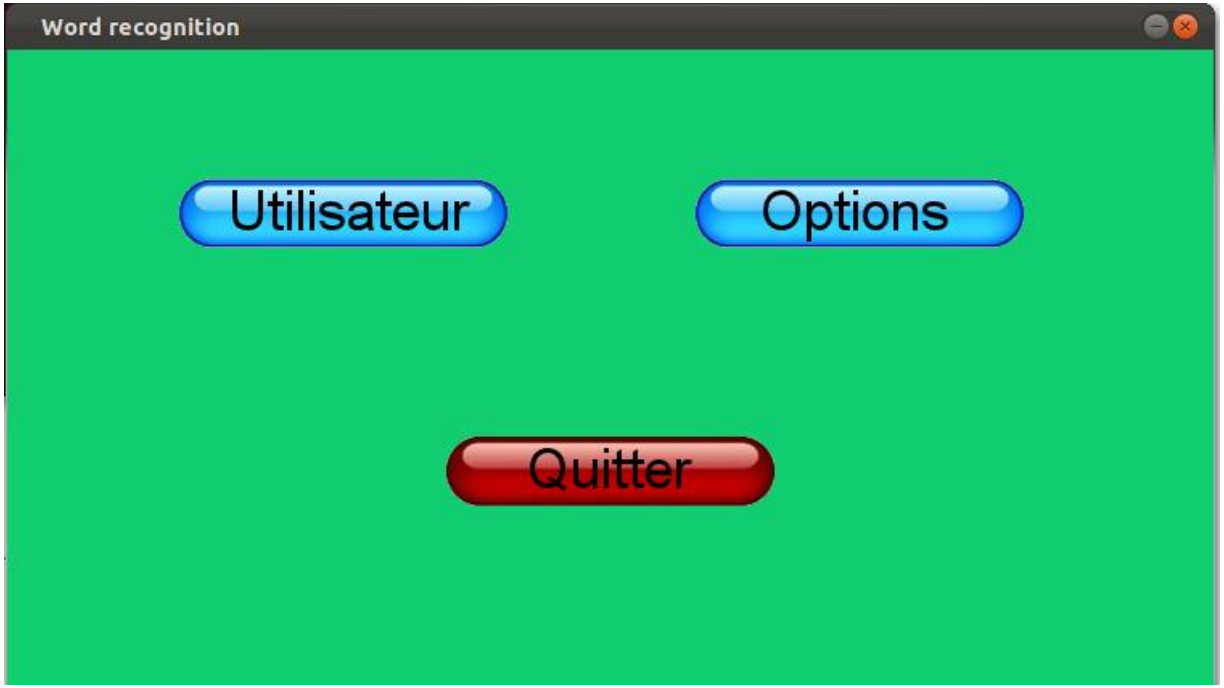
I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play



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Menu

I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play

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Menu

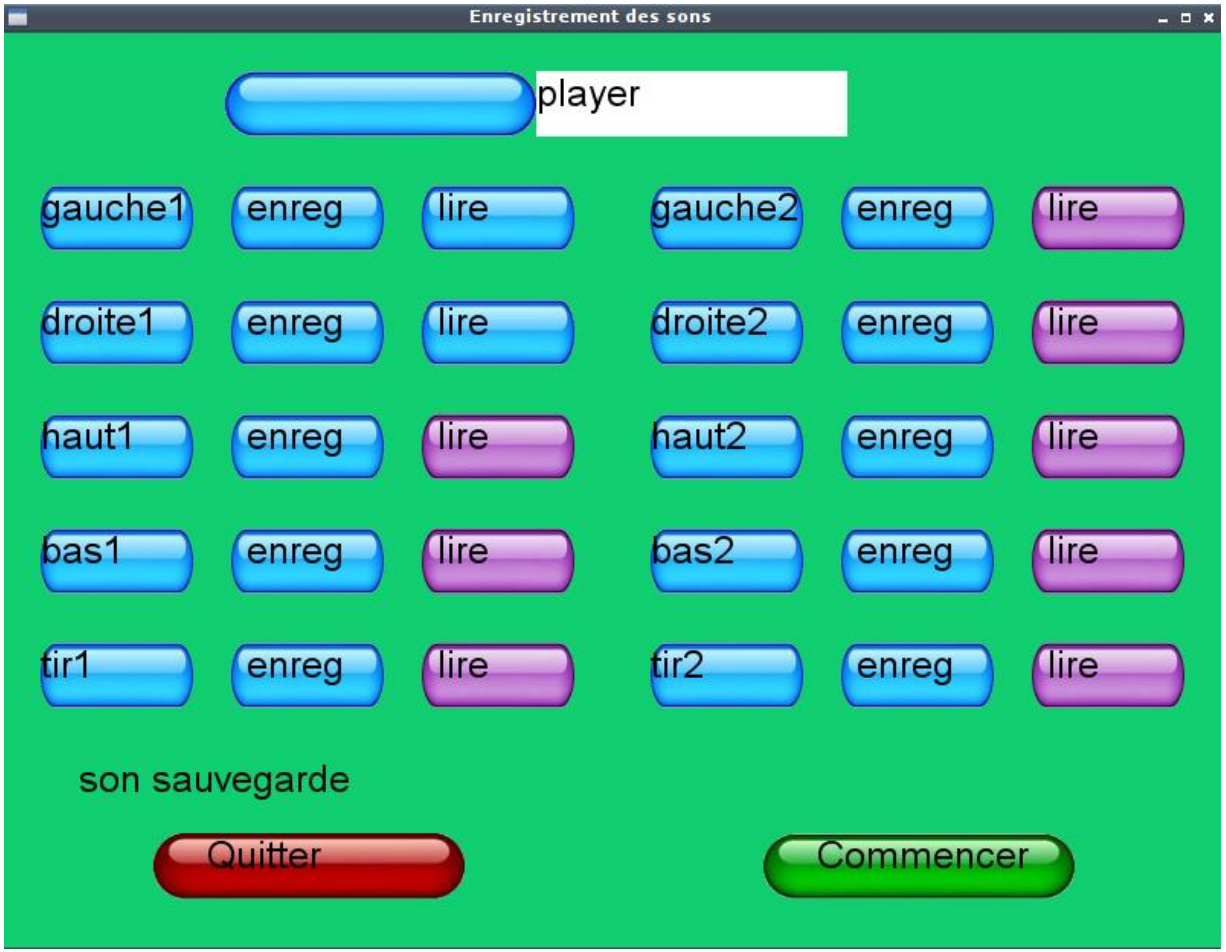
I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play



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Menu

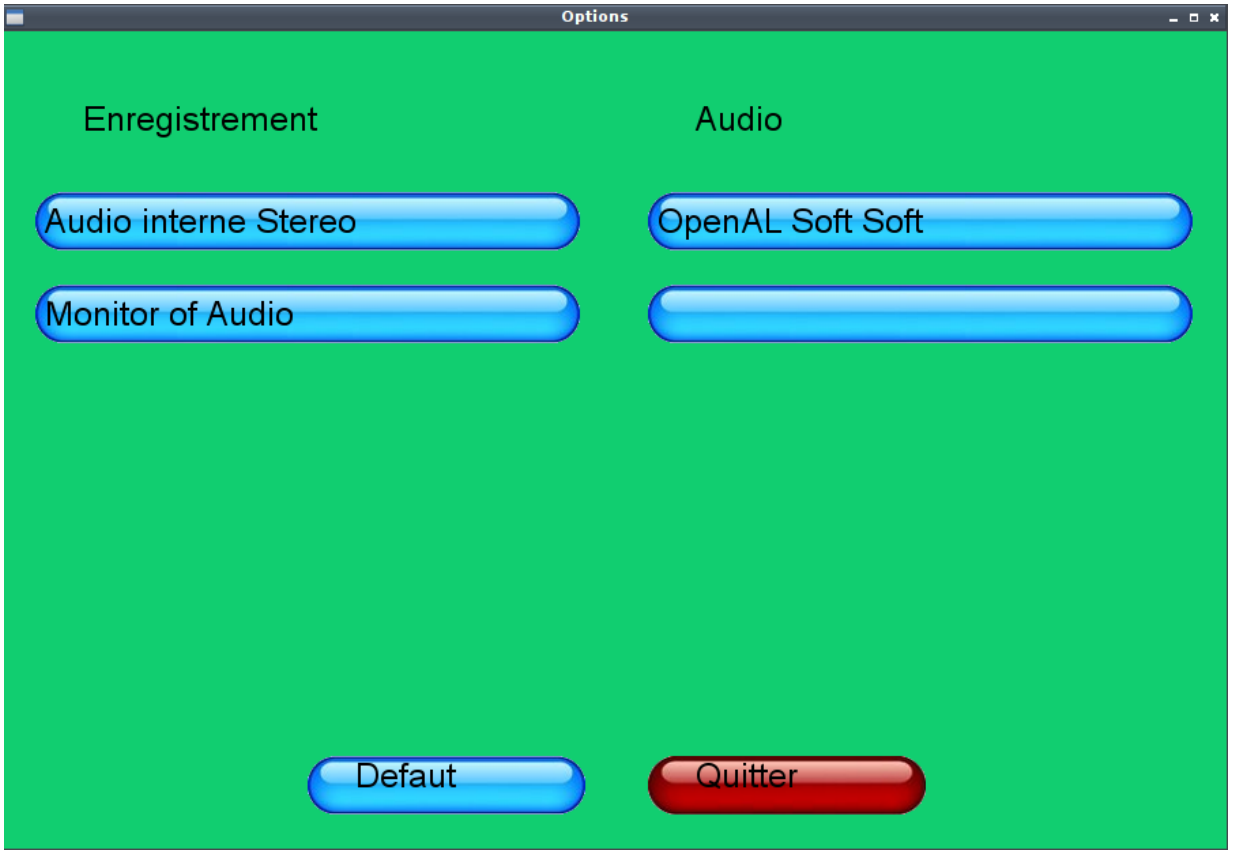
I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play



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Human Machine Interface

I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play

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Human Machine Interface

I. Sound treatment
II. Comparison
III. Human Machine Interface
   a. Menu
   b. How to play

Way in:

Way out:

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Human Machine Interface

I. Sound treatment
II. Comparison
III. Human Machine Interface
   a. Menu
   b. How to play

Moving: 

Waiting: 

Wall: 

Fire: 

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Human Machine Interface

I. Sound treatment

II. Comparison

III. Human Machine Interface

a. Menu

b. How to play

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Conclusion

- Interesting project
- Apply our courses(TNS, Infographie, C++)
- Deepen our knowledge
- Others upgrades?

References

- J. Leroux « Dynamic time warping », « HMI », TNS
- Wikipedia
- J. Mariani « Advances and trends in automatic speech recognition », p245-252, 1990
- …

Let’s practice !

Do you have any question?

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