Motion and Emotion or how to align emotional cues with game actions

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Abstract

This paper reports a preliminary study on expression of emotion in sport in French. The study is conducted on texts and natural speech data, recorded from comments of sportive events during the Rugby World Cup 2007. Our aim is to semi-automatically extract passages representative from emotional behaviours in sports comments. As we consider that it is necessary to combine several viewpoints on a same object to avoid inconsistencies, we collected a set of various types of data about one sequence. For one video match, we recorded audio and textual data from professional and non-professional speakers. To extract representative passages, we align an emotional profile defined by linguistic analysis (i.e. prosodic and terminological parameters) with sequences of a sport action. The sequences are retrieved as segments of signal with their transcription. The alignment is made by the matching of a termino-ontological resource with several viewpoints (emotion, sport, discourse types) of several granularities (prosody, emotional terms and sports lexicon). It will be used to permit automatic emotion segments extraction in multimedia documents for corpus collection.

1. Introduction

The emotion of winning or emotional becoming of sportsmen and women is well known. But supporters also ride on high emotion to victory. The emotion that is interesting us here is the emotion that makes supporters "cheering" but also "praying" for the success of their team as it was said in newspapers during the Rugby World Cup 2007. Without trying to understand why sport is leading to emotion, we consider that the behaviour of supporter watching a match is well representative of emotion. We also consider that supporters become all the more emotional when some crucial actions in the match happen.

We consider emotion as defined by K.R. Scherer (Scherer, 2000). In the cognitivist approach, emotion is a relatively brief phenomenon, a reply to the organism according to the evaluation of an external or internal event.

Our aim is to extract passages representative from emotional behaviours in a corpus of Rugby World Cup comments.

We want to align emotional profile (a set of prosodic and terminological parameters manually defined for active emotion by an analysis) with segments of signal representative from a sport action. The alignment is made by the matching of parts of ontologies with several viewpoints (emotion, sport, discourse types) of several granularities (prosody, emotional terms and sports lexicon).

In this paper, we first present our positioning on corpus and emotion. We then describe the corpus we used and how it has been collected. We then expose how the Termino-Ontological viewpoint of the sport ontology has been built. The fourth part explains the prosodic analysis led on a collection of manually extracted segments of sport action and providing us with an active emotion profile. Lastly, we explain how we use the built ontology to index segments of signal by means of a corpus analysis tool enabling lexical, prosodic and discourse analysis.

2. Positioning

In the emotion field and especially in the numerous studies about vocal expression of emotions, the corpus is a central problem. Its choice is not trivial.

A lot of research works are based on simulated emotional expression, with actors (professional or not) playing roles (Fónagy, 1983), (Léon, 1993), (Scherer, 1995). This allows for a tighter control of the quality of the recordings and also to select the emotion to be acted.

Moreover, recently more and more studies have insisted on the necessity of using natural emotional speech. It enables to access authentic expressions (Douglas-Cowie *et al.*, 2000).

However, this latter choice raises difficulties. To obtain this data brings up ethical as well as practical difficulties. It's hard to have good sound quality records outside anechoic room (Campbell, 2001).

The media form an interesting source for spontaneous speech (Chung, 2000) but it could be harder to find a discourse type favouring emotion expression.

But sport is a phenomenon likely to arouse emotion. We all know the jubilant or desperate crowd of supporters after a final world cup match.

In addition to that, a lot of sports meeting are broadcasted, commented and are the subject of journalistic papers. These comments, oral or written, often provide authentic emotional expressions.

The idea here is to "duplicate" our sports emotion oral corpus with written commentaries in order to deal with prosodic parameters, semantic parameters and pragmatic parameters.

To enable a pragmatic analysis of the emotion in sports, we foresee two categories of commentators. The first types of comments are produced by journalists or official commentators and the second by supporters behind the TV.

We claim that our corpus enables us to tackle the

question of expression of emotion from different linguistic approaches, as listed in (Kerbrat-Orecchioni, 2000): lexical approach, morpho-syntactic approach, pragmatic approach, interactionnist approach including the intercultural variation.

Likewise, it helps us considering the nature of such emotional expression, as sport emotion is not straightforwardly listed as basic emotion (anger, joy, sadness, fear, disgust).

Now we present the corpus (oral and written) we use to define emotion parameters within our context.

3. Corpus Description

3.1 Oral

We chose to work on a spontaneous speech corpus and specifically on a sports comments collection recorded during the Rugby Word Cup 2007. The collect was carried out from September the 7th to October the 20th.

Our oral corpus is formed of two sub-corpora corresponding to two types of speaker and record.

3.1.1. Journalistic corpus
Our first sub-corpus consists of a sports comments expressed by journalist. They comment the live-broadcasted matches of the championship.

The matches have been digitized in order to keep the audio sound, mono, with a sampling frequency of 22050 Hz or 44100 Hz.

We recorded the comments in several languages, from the French, Italian, English and Japanese TV.

We collected the broadcasting of 19 matches for French, which is approximately equivalent to 36 hours of recording. For other languages, the corpora are lighter, but we want to process them differently in order to compare cultural behaviours. We recorded only two matches / 3.3 hours for English, 3 matches / 5.6 hours for Japanese, and one match / 1.9 hour for Italian. The journalistic oral corpus is then formed by 25 matches or a 46.8 hours record.

The comment is shared by several speakers. Usually, the action is described by the journalist who is the main commentator of the match. That's why he has the longest speech duration. A retired player is associated as a specialist. He permits to create an interaction with the journalist. When a critical phase of the game is playing or has been played, he is explaining some strategic elements often as a dialog with the commentator. This dialog aims at explaining an action to the viewer audience in a more vivid way. A third speaker sometimes appeared. He is near the pitch and intervenes when some changes are made in the composition of the team or some exchanges occurred on the field among the players and the referee for example.

3.1.2. Supporter corpus
The 2nd sub-corpus is different from the journalistic corpus by the type of speakers and of record.

We recorded the comments of supporters watching the game at the TV or on an open-air screen. This corpus is only in French.

We collected sound recording for 18 speakers, 14 men and 4 women, during 7 different matches, which represents 10.55 hours of recording.

This corpus is characterized by its amount of overlapping and "sounds". More than 200 "noises" of different types are recorded: breathing, exhalation, puff, sounds of the mouth, sounds of the throat, cough, laugh, sneer, whistle and hiss…

	Oral	Written
Professional comment	1.9 hrs*	31 000 words
Supporter comments	1.5 hrs*	4000 words
*Cultural/languages and sex comparison enabled		

Table 1: Average corpus size for one match

The quantitative description of the corpus is given by match because all data is not yet available for the written corpus. In fact, the written corpus is transcription of the oral one with the tool Transcriber [1]. The transcription is a time-costly activity and is not finished yet for the 36 hours of recording in French. Likewise, the duration of recording is not representative of the speech duration itself.

3.2 Written

3.2.1. Journalistic corpus
The journalistic written sub-corpus is collected from two main sources. The first one is newspapers - mainly on-line - (20 minutes, sport365, Le Figaro, sport24, afp, lexpress, Le Monde, radiofrance, rugbyrama, L'Equipe [2]). The second one is the transcription of the professional comments.

The texts are only in French and for one match we gathered an average of 15000 words from the press and 16 000 from the transcription.

3.2.2. Supporter corpus
The supporter written sub-corpus is also a French one for practical reasons.

It is formed of the transcription of the supporter comments, corresponding to 3 300 words for one match and a collection of blog comments about the match, about 800 words.

This corpus is characterized by colloquial terms and expression at the lexical level and syntactic disruptions at the morpho-syntactic level.

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[1] http://trans.sourceforge.net/en/presentation.php
[2] 20 minutes: http://www.20minutes.fr/; Sport365: http://www.sport365.fr/; Le Figaro: http://www.lefigaro.fr/; Sport24: http://www.sport24.com/; AFP: http://www.afp.com/; L'Express: http://www.lexpress.fr/; Le Monde: http://www.lemonde.fr/; Radiofrance: http://www.radiofrance.fr/; Rugbyrama: http://www.rugbyrama.fr/; L'Equipe: http://www.lequipe.fr/ accessible on the{20080410}

The systematic comparison of these two corpora would bring us information about behaviours in sports at phonological, terminological and syntactical levels within a pragmatic approach.

Since our aim is to semi-automatically extract passages representative from emotional behaviours in sports comments, we want to use our corpus to build a typology of relevant emotional expressions in sports discourse.

To define the required parameters, we lead a two-fold-analysis: prosodic and semantico-lexical. In the next section, we present how we built a semantico-lexical model.

4. Termino-Ontological viewpoint of the sport ontology

The semantico-lexical analysis is led in taking into account several features of the term: its form, its organization, its sense(s), its use(s) – i.e. context -.

This analysis is based on now classical text analysis methods as we chose to extract terms and relation from our corpus.

Our methodology is as follow:

(1) The first step is to constitute this corpus.

(2) The second step is to extract terms from these texts and then to identify which one are the most representative of the domain (tf-idf[3] frequency and Named Entities semi-automatic tagging) and which syntactic constituents and patterns are relevant in our corpus.

(3) We are then able to extract paradigmatic as well as syntagmatic relations among terms to structure them:

      a. We first identify some heuristic rules;

      b. Secondly, we automatically identify relations from these rules

      c. And thirdly, we structure the relevant terms

(4) We finally represent this information in formalism suitable for a Termino-Ontological Resource (TOR).

To build this TOR, we re-used and adapt some existing tools for French language parsing and semantico-syntactic corpus tagging. Extracting terms is a crucial step in the TOR building. Numerous efficient tools exist for several languages. In our French language context, tools as Termino (David and Plante 1990), FASTR (Jacquemin and Bourigault 2003) MANTEX (Frath, *et al.*, 2000), ACABIT (Daille 1999), LIKES (Rousselot, *et al.*, 1996) can be relevant for our purpose but are not strictly available or need a lot of configuration by user. Syntex (Bourigault, *et al.*, 2005) is another tool which is available and a robust analyzer. It uses linguistics resources to analyze a corpus in syntactic dependencies and gives contextual result enabling us to use patterns. Syntex permits to parse natural unstructured language as in our corpus. We then plug an extracting algorithm in its outputs. The module we developed is searching for syntactic constituents matching morpho-syntactic patterns (Lortal *et al.*, 2007). These patterns extract complex nominal phrases (nominal syntagms modified by

prepositional syntagms) as well as simple verbal phrases (a verb followed by a nominal phrase). We always extract the largest covering pattern and couple this extraction with a term frequency analysis and a named entity tagging. Once extracted, as they are limited, terms are manually organized under concepts.

To build the ontological level, we based our conceptual level on an existing rugby thesaurus (Hourcade, 1998). It contains more than 6000 French and English rugby terms. We re-used about 1500 terms for structuring our TOR. But this is to be refined with a larger journalistic written corpus. In the same way, the TOR is going to widen out with a larger supporter written corpus.

This TOR is to be used as a set of tags to annotate actions during the match. In order to annotate the emotional expression in our corpus, we are manually building the emotional termino-ontological viewpoint from a fine-grained discourse analysis and the analysis of several emotion models (OCC (Ortony *et al.*, 1988), SEC (Scherer, 1988), Plutchik's model (Plutchik, 1980). We also examine the re-use of the W3C[4] emotion markup languages (Schröder *et al.*, 2007).

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Serenity hasDegree Low
         isComposedOf Optimism
         isComposedOf Love
         is Passive
Joy      hasDegree Medium
         isComposedOf Optimism
         isComposedOf Love
         is Active
Ectasy   hasDegree High
         isComposedOf Optimism
         isComposedOf Love
         is Active
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Figure 1: Emotion Conceptual Level in TOR

5. Prosodic analysis and active emotion profile

For this study concerning prosodic analysis, we focused on the fundamental frequency parameters and the rhythm of speech. Intensity and energy features were rejected, because of the digitalized or noisy nature of the corpus. In the journalistic corpus provided from TV, we cannot control the recording and broadcasting conditions. Intensity and energy features may have been modified during the broadcasting processes. Moreover, concerning the supporter corpus, we also rejected intensity and energy features. The recordings were too noisy.

5.1 Fundamental Frequency

The fundamental frequency (F0) defines the pitch level of the voice. Pitch variation and contours are pertinent features for vocal studies of emotions (Bänzinger, *et al.*, 2001).

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[3] Term-frequency / Inversed-Term Frequency

[4] http://www.w3.org/2005/Incubator/emotion/XGR-emoti on-20070710 {20080410}

F0 measures were extracted automatically with WinPitchPro (Martin 2000). This software takes into consideration the transcriptions and signal segmentations first made with Transcriber. WinPitchPro recognises all speakers created withTranscriber and processes them separately in specific layers. F0 was extracted from all the speakers turns (at a sampling rate of 20 ms). Some statistics were performed, calculating the minimum, maximum, mean and range of F0 for each speaker turn.

The voice amplitude of each speaker, i.e. the delta difference between the maximum and the minimum of fundamental frequency, was divided in four equal registers: Low (L), Medium-Low (ML), Medium-High (MH), and High (H). The F0 values of these registers vary from speaker to another one. F0 means were calculated for each speaker turn, using F0 automatic extractions, and then each value was classified in the corresponding register.

5.2. Rhythm

We measured the speech rate, i.e. the number of syllables uttered in one second of speech (containing pauses, disfluencies etc.).

When segmenting in speaker turns and transcribing the recordings, any silent segment above or equal to 200ms is considered as silent pause within the discourse and as so, removed from the speaker turn. The emotion felt by the viewer watching sports entertainment is not recognised as it is as an emotion. In fact, it is not one of the basic acknowledged emotion.

So, we are not able to annotate our corpus with a perceptive analysis explaining which emotion is in the speaker comments. On the other hand, following our hypothesis according to which specific game periods constitute a stimulus which leads to an emotional reaction from the speaker, then we are able to determine which prosodic parameters systematically intervene in the sports discourse for one game action.

Our hypothesis is that the emotion felt and expressed by the viewer watching sports entertainment corresponds to an active emotion profile. Concerning the prosodic parameters, an active emotion profile is characterized by an increasing of F0 values, of intensity and speech rate (Scherer, 2003). By analyzing prosodic realizations of the viewer for one game action, our aim is to verify our hypothesis and define a vocal profile of the "emotion" in sports discourse.

6. The Drop Analysis

6.1. Prosodic Analysis

In this part, we show an example of prosodic analysis made on the sportive comments realized by French journalists, during the match which opposed France against Argentina. We focused on a specific game action : the drop. The drop is "a kick made as the ball bounces after being dropped to the ground" (s.v. drop; Hornby, 1989).

We present the prosodic analyses realized on the discourses of the two main French journalists, two male speakers. Moreover, assuming that emotion expressed in the sportive discourse is a reaction to the view of the game action, we focused our analyses to the descriptive parts of the discourse. Indeed, we consider that the journalist's explanations,, concerning a definition of the drop, to the attention of the TV's viewers, are not available.

We analysed all the descriptive parts referencing to the kick-drop in the both journalists' discourses.

Each description is constituted by two to five speech segments (delimited by silent pauses), for an average duration of 6.87 seconds. So, the drop is a relatively brief game action.

Both linguistic and prosodic analyses permitted to distinguish three periods in the descriptive discourse. First, the journalist announces the game action; then he describes live the game action, this period of the description forms the main point of the discourse; finally, the effects of the game action are described and commented.
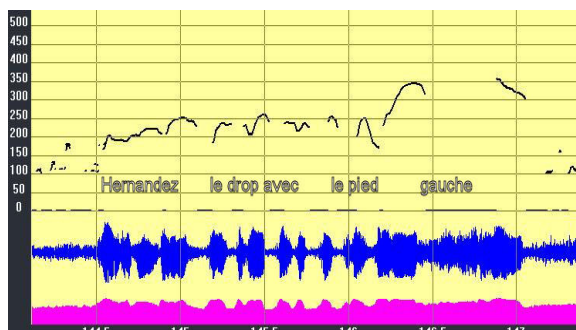

Figure 2: Pitch contour of the sentence "Hernandez le drop avec le pied gauche/*Hernandez the drop with the left foot*", corresponding to the first description period, announcement of the game action.

The figure 2 shows an example of a pitch contour for an announcement of the game action. In this first period, the action game and the name of the player, who has been designed to do the action, are announced.

We can observe that the pitch contour at the beginning of the speech segment is quite flat, contrasting with the deep rise of F0 on the penultimate syllable.

The second speech segment of this example of game action's description constitutes both the description of the drop and the results of this action.
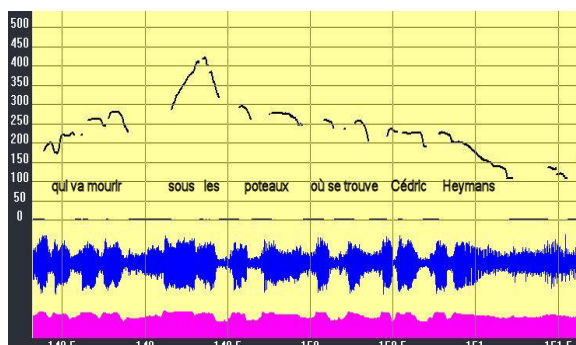
Figure 3: Pitch contour of the sentence "qui va mourir sous les poteaux où se trouve Cédric Heymans/*which goes dying under the posts where Cédric Heymans stands*"; corresponding to the second and third description periods, i.e. description of the action and its results on the game.

We observe that the F0 mean (240 Hz) and the speech rate (4.71 syll./sec.) did not vary from 1st to 2nd speech segment. On the other hand, F0 maximum increased up 425 Hz. This high pitch value corresponds to the most crucial period of the action. By contrast, the end of the sentence, describing the results of the action, shows a regular fall of F0 contour.

These examples of pitch contours show that an important prosodic variation corresponds to the period in the journalist's discourse, which describes the action being led. Furthermore, the prosodic characteristics seem to be the same that the ones relevant for active emotion profiles, as anger or joy, i.e. an increasing of F0 mean, maximum and range. Speech rate do not seem to correspond to this profile, but we can propose the hypothesis that the speech rate of the speaker, in the description periods of discourse, follows the conduct of the game action, rather than expresses the speaker's emotion.

6.2. Semantico-lexical analysis

We have two main perspectives on our semantico-lexical analysis. The first one is a terminological analysis and the second an emotional analysis (emotion marks in discourse).

6.2.1 Terminological analysis

The two corpora have a lot of meta-discursive discourse during the comments. The speakers explain the terms they use to comment, and even comment them. The analysis permits us to retrieve the terms, mostly expressions, which slip through the net of our patterns. In (1) the speaker uses a simple pattern for picking out synonyms, using "qu'on appelle aussi / *that we also call*" to link "coup de pied tombé/literally *felt kick-drop kick*" with "drop/*drop*".

(1) speaker#1: coup de pied tombé pour ce renvoi qu'on appelle aussi drop
   speaker#1: drop kick for this drop out that we also call drop

To retrieve new terms, "rugbalistic" terms as French rugbymen say, the manual analysis is compulsory as it often come with long comments. For example the hierarchy (2') is coming fro the analysis of the sequence (2).

(2) speaker#2: hé bé vous jouez au pied
speaker#2: hey bey you play with foot[5]
speaker#2: ou des chandelles c'est-à-dire en l'air la quille
speaker#2: or up and under kick that is to say the skittle
speaker#1: c'est la chandelle c'est votre jargon rugby
speaker#1: up and under kick that is your rugby jargon
speaker#1: d'ailleurs c'est très bon hein
speaker#1: besides it is really good (hein)
speaker#2: la quille c'est la chandelle ou alors un drop ce que vous avez vu par Contepomi
speaker#2: the skittle is the up and under kick or also a drop what we saw with Contepomi
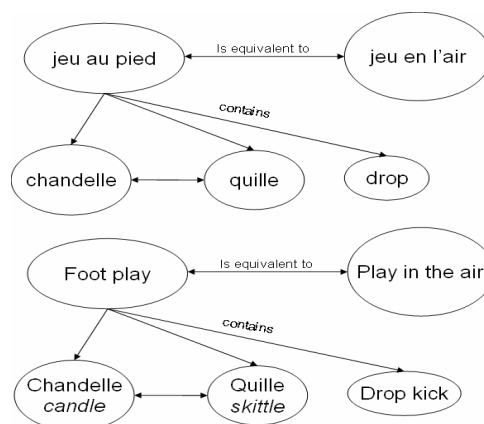
(2')

Figure 4: Rugby TOR (part)

In future, we hope, thanks to terminological analysis, to compare the terms between specialist in professional context and supporters in leisure context. The second perspective on this analysis is to be able to recollect corpus year after year, since each seasons is marked by the arrival of new terms as *ovalie* and *terre d'ovalie* – meaning something as *ovaly country* and *land of oval sport*- some years ago. Today these terms are accepted and used for marketing and as a community term (among rugbymen).

6.2.1 Emotion mark analysis

The lexical analysis of emotion is really different from the written journalistic corpus and the oral or written supporter corpus.
As the first one is descriptive and public, we can find terms about what the speaker feels or what the players feel. We can find terms as: tomber de haut/ *to fall headlong*, désillusion/ *disillusion*, doucher les ambitions/ *to tell off ambitious*, trop nerveux/*too nervous*, tendu/*tense*, tétanisé/*tetanized*, intentions offensives/*offensive intentions*, jeter un froid/*to cast a chill*, perturbé/*upset*, faible/*weak*, volontaire et enragé/*headstrong and keen*,…
Another analysis on emotion to be done is the morpho-syntactic analysis (Kerbrat-Orecchioni, 2000). We also observed that a typographic analysis may also leads us to useful patterns of emotion expression as shows (9). The typography used is representative a means of emotional expression in written comment.

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[5] nota: you do not run the ball

(9) ROUGERIIIIIIIIE !!!
ROUGERIE !!!
Willx est très en colère. Les 17 points encaissés en une mi-temps, il a pas aimé!
Willx is really angry. The 17 hit points in one half-time, he *don't* like it !
VOILA!!
HERE WE ARE!!
PUNITION- Corleto !!!!
PUNISHMENT – Corleto !!!
The second one is really much more rude and is about what the speaker feels. Examples from (1) to (8) show the terms we can find.
(1) speaker#1: ah c'est pas bien ça les Français de siffler comme ça mais c'est logique
speaker#1: ah it's naughty that he French to whistle this way but it's logical
(2) speaker#1: ben hé qu'est-ce qu'il fait non il dit rien là ben si ah ben quand même
speaker#1: ben hey what is he doing no he is saying nothing ben yes ah ben well really
(3) speaker#1: putain l'autre lui passe par dessus alors quelquefois je peux être ordurier quand même hein
speaker#1: fuck the other is passing above so sometime I can be filthy well really hu
(4) speaker#1: ouais mais va falloir taper là les mecs putain les mecs il va falloir quand même qu'ils se décident à aller
speaker#1: yeah but should hit now guys fuck guys they should decide on to go finally
(5) speaker#1: pas vrai ça
speaker#1: not possible
(6) speaker#1: qu'est-ce qu'ils font là les mecs ils
speaker#1: what are they doing now guys they
(7) speaker#1: qu'est-ce qu'il y a comme foot hein
speaker#1: so much football hu
(8) speaker#1: euh il a pas mis le pied en touche le mec là
speaker#1: hey he didn't put his foot in touch the guy here

The terms we find are not crucial to add to a terminology and extend the coverage our TOR. However, these speakers turns, when combine with a prosodic analysis strengthen the hypothesis of (Mathon, 2007) saying that when the lexicon is strongly marking an emotion, the prosodic parameters are lessened. The validation of this hypothesis underlines the asset of an automatic extraction of sequences.

7. A tool for ontology based indexation of segments of signal

The prosodic analysis led on a collection of manually extracted segments of sport action and providing us with an active emotion profile is to be refined by further analysis on a larger automatically extracted corpus. However, we can already explain how we will use the built TOR to index segments of signal by means of a corpus analysis tool enabling lexical, prosodic and discourse analysis.
The first requirement for such a tool is to have prosodic processing functionalities. That's why we

base our module on Winpitch (Martin, 2000). WinpitchPro allows real time monitoring of recordings (spectrogram, Fo, etc.), high precision segmentation, speech turns overlapping, assisted alignment of existing transcription, automatic building of speech segments database (XML output), prosodic morphing. WinpitchPro can also process multimedia files (audio/video or text with its corresponding signal).

Figure 5: Video/Prosody/Signal/Transcriptions alignment

We aim at optimizing WinpitchPro with functionalities as:
- Visualization of already aligned corpus (vidéo/signal/texts) (Fig.5)
- Speaker turns synchronisation based on the signal time
- Automatic and on the fly prosodic parameters calculus based on syntactic groups (not turns)
- Segment extraction based on defined on multi-level profiles (lexical - semantic - prosody levels)

At the moment, we are refining these specifications and launching a global project on multi-linguistic level analysis tool.

8. Conclusion

We presented here a preliminary study aiming at defining lexically and prosodically the emotion or the emotions provoked by a sport show. These emotions are expressed in both journalistic and supporter discourse
The prosodic level analysis enables us to say that the emotion expressed in speech sequences describing a specific action in the game has parameters similar to an active emotion. This observation leads us to envisage the detected prosodic parameters as evidences of the speaker excitement when the action occurs.
While we do not deem our results as definitive or universal, we wish to use them as prosodic parameters associated to lexical parameters in corpus processing. The association of these prosodic and lexical parameters with emotion concepts considered

as universal creates a large and fine-grained termino-ontological resource. The TOR is used to support multimedia documents annotation. The fine and automatic annotation of an oral corpus will enable us going further in the automatic extraction of representative passages. It represents an important saving of time and a finer linguistic analysis of our journalistic sports discourse corpora and its expressivity marks.

We still have a lot of question about the variation of emotion provoked by the sports show. Does it vary with the game actions, with the spirit of the spectator (pro or cons the winning team), or with the expressed spectator mood (terms in use)? Is this emotion in sports is universally expressed or culturally and linguistically dependant? Our corpus is still shallow-analysed and we hope to dig it thanks to a cross domain analysis.

9. Acknowledgements

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