# Contextual Valence Shifters Supporting Affect Analysis of Utterances in Japanese

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**Abstract:**
The paper presents a support method for affect analysis of utterances in Japanese. One of the problems in the system for affect analysis developed by us before was confusing the valence of emotion types in the final stage of analysis. The cause of this problem was extracting from the utterance only the emotive expression keyword without its grammatical context. To solve this problem we enhance the emotion types extraction procedure in the baseline system with grammatical analysis using Contextual Valence Shifters (CVS). CVS are words, or phrases such as "not", "very much" "not quite", which determine the semantic orientation of the valence of emotive expressions.

**Keywords:** Affect Analysis, Contextual Valence Shifters.

## 1. Introduction

Research in the field of Affective Computing has been gathering popularity of researchers since being initiated only a little over ten years ago [1]. The interest in such research is usually focused on recognizing the emotions of users in human-computer interaction. In the most popular methods the emotions are recognized from: facial expressions [2], voice [3] or biometric data [4]. However, these methods, usually based on behavioral approach, ignore the semantic context of emotions. Therefore, although achieving good results in laboratory, such methods become useless in real life. A system for recognition of emotions from facial expressions, assigning “sadness” when a user is crying would be critically mistaken, if the user was e.g. cutting an onion in the kitchen.

This led to formation of Affect Analysis - a field focused on developing natural language processing techniques for estimating the emotive aspect of text. There were several attempts to achieve this goal for the Japanese language. For example, Tsuchiya et al [5] tried to estimate emotive aspect of utterances with a use of association mechanism. On the other hand, Tokuhisa et al [6] used a large number of examples from the Web. However, none of the present methods is capable to perform a deep contextual analysis. Ptaszynski et al [7] proposed a pioneer method for Affect Analysis of utterances basing on the idea of two-step classification of emotive content – general emotiveness and specific emotion types. However, one of the problems with this method was confusing the valence polarity of emotive expressions in the last step of analysis. To solve this problem and to push Ptaszynski’s method one step towards a deeper contextual analysis of emotive content we decided to apply the idea of Contextual Valence Shifters to the baseline system to enhance the specific emotion types determination.

## 2. Contextual Valence Shifters

The idea of using Contextual Valence Shifters (CVS) in Sentiment Analysis has been first proposed by Polanyi and Zaenen [8]. They distinguish two kinds of CVS: negations and intensifiers. The group of negations contains words and phrases like “not”, “never”, and “not quite”, which change the valence polarity of semantic orientation of an evaluative word they stick to. The group of intensifiers contains words like “very”, “very much”, and “deeply”, which intensify the semantic orientation of an evaluative word.

So far the idea of CVS analysis was successfully applied to the field of Sentiment Analysis of texts in English [9]. A few attempts on Japanese ground [10] show that it is also applicable for the Japanese language. Examples of negations in the Japanese language are grammatical structures such as: *-nai*[1] (not-), *amari -nai* (not quite-), *mattaku -nai* (not at all-), or *sukoshi mo -nai* (not even a bit-). Intensifiers are represented by such grammatical structures as: *totemo-* (very much-), *sugoku-* (-a lot), or *kiwamete-* (extremely).

However, till now there were no attempts to apply CVS in the field of Affect Analysis neither in English nor in Japanese. This paper presents the first pioneer attempt of that kind.

## 3. Definition and Classification of Emotions

Nakamura [11] defines emotions as every temporary state of mind, feeling or emotional state evoked by experiencing different sensations. This definition is complemented by Beijer’s [12] definition of emotive utterances, which he describes as every utterance in which the speaker in question is emotionally involved, and this involvement is expressed linguistically.

[1] In this paper we use italic for Japanese expressions.

Nakamura [11], after a thorough study on emotions in Japanese language, proposed a classification of emotions into 10 types - most appropriate for the Japanese language. That is: *ki, yorokobi* (joy, delight), *do, ikari* (anger), *ai, aware* (sorrow, sadness), *fu, kowagari* (fear), *chi, haji* (shame, shyness, bashfulness), *kou, suki* (liking, fondness), *en, iya* (dislike, detestation), *kou, takaburi* (excitement), *an, yasuragi* (relief) and *kyou, odoroki* (surprise, amazement).

## 4. ML-Ask

Based on the linguistic approach and assumptions described above Ptaszynski et al. [7] constructed ML-Ask (Emotive Elements / Emotive Expressions Analysis System) for analyzing the emotive contents of utterances. The system uses a two-step procedure: 1) Analyzing the general emotiveness of utterances by calculating the emotive value representing the strength of the conveyed emotions; 2) Recognizing the particular emotion types. The system is based on Ptaszynski's idea of two-part analysis of realizations of emotions in language into:

1. *Emotive elements*. Indicating that emotions have been conveyed, but not detailing what specific emotions there are. This group is linguistically realized by such subgroups as interjections, mimetics, or vulgar language. Examples are: *sugee* (great!), *wakuwaku* (heart pounding), *-yagaru* (a vulgarisation of a verb);

2. *Emotive expressions*. Parts of speech, that in emotive sentences describe emotional states. This group is realized by such parts of speech like nouns, verbs or adjectives. Examples are: *aijou* (love), *kanashimu* (feel sad) and *ureshii* (happy), respectively.

The emotive element database was built using data from different research [13], [14], [15], [16] and divided into interjections, mimetics, endearments, vulgarities, and representations of non-verbal emotive elements, such as exclamation marks or ellipsis. The database of emotive expressions contains Nakamura's collection [11].

### 4.1 Affect Analysis Procedure

For a textual input provided by the user, two features are calculated in order: emotiveness of an utterance and specific type of emotion. Firstly, the system searches for emotive elements in the utterance to determine the emotiveness (emotive / non-emotive). Secondly, in utterances described as emotive the system searches for emotive expressions to determine the specific type of the conveyed emotions. The flow chart of the system's procedure is shown in Figure 1, and an example of analysis performed by ML-Ask is shown in Table 1.

**Table 1.** An example of analysis performed by ML-Ask

| | |
|---|---|
| **Utterance** | *Kono hon saa, sugee kowakatta yo. Maji kowasugi.*<br>(That book, ya know, 'twas a killer. It was just too scary.) |
| **Emotive elements** | *saa, sugee, -yo, maji, -sugi*<br>(**Emotive value** = 5) |
| **Emotive expressions** | *kowai* |

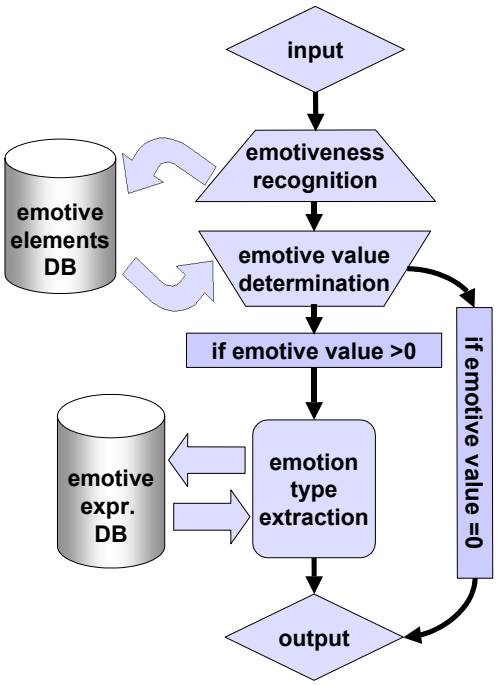


**Figure 1** ML-Ask system flow chart.

## 5. Applying CVS to ML-Ask

One of the problems in the procedure described above was confusing the valence polarity of emotive expressions. The cause of this problem was extracting from the utterance only the emotive expression keywords without its grammatical context. One of the utterances showing such case is presented in Table 2. In this sentence an emotive expression is a verb *akirameru* (give up) and a CVS phrase is *-chaikenai* (You cannot-), suggesting that the speaker is in fact

To solve this problem we apply the analysis of Contextual Valence Shifters to change the valence polarity of emotive expressions in utterances containing CVS structures. However, using only the CVS analysis we would be able to find out about an appropriate valence of emotions conveyed in the utterance, but we would not know the exact emotion type. Therefore, to specify the emotion types in such utterances we apply the idea of two-dimensional model of affect.

## 6. Applying 2-dimensional Model of Affect

The need of changing the valences in emotion estimation research is a common problem. However, it is not uncommon that researchers use a valence changing patterns constructed by themselves and without any scientific grounds. For example Tsuchiya et al [5] used their own list of emotions contrasting emotions. They do not notice however that, as it is argued by Solomon [17], the fact that two emotions are in a contrast is

not a matter of a stiff division, but is more profound and context dependent. As we assumed this profundity could be specified with a help of 2-dimensional model of affect.

The idea of a 2-dimensional model of affect was first proposed by Schlosberg [18] and developed further by Russell [19]. Its main assumption is that all emotions can be described in a space of two-dimensions: the emotion's valence polarity (positive negative) and activation (activated / deactivated). An example of positive-activated emotion would be an "excitement"; a positive-deactivated emotion is, for example, a "relief"; negative-activated and negative-deactivated emotions would be "anger" and "gloom" respectively. This way four areas of emotions are distinguished: activated-positive, activated-negative, deactivated-positive and deactivated-negative (see Figure 2).

**Table 2** An example of failure of emotion description in ML-Ask

| | **Sentence author's tagging** | **ML-Ask's output** |
|---|---|---|
| *Akiramecha ikenai yo!* (You cannot give up!) | [joy, delight], [excitement] | [dislike, detestation] |

## 7. Description of CVS Procedure

An example of this supplementary procedure is described as follows. When a CVS structure is discovered, ML-Ask changes the valence polarity of emotion conveyed in the sentence. According to the Russell's model, every emotion is placed in one of the four spaces. Some however have a tendency to appear in two of the quarters. The appropriate emotion is determined as the one of valence polarity parameters different to the contrasted emotion but with the same activation parameters. If an emotion was located in only one quarter, e.g. positive-activated, the contrasting emotions would be determined as negative-activated.

A change in the output is shown in the Table 3. Originally ML-Ask selected [dislike, detestation]. This emotion is located in both quarters of the negative valence space. Therefore ML-Ask determines the new emotion types as positive and belonging to both of the positive quarters. The new proposed emotion types are: [joy, delight] and [liking, fondness] belonging to both positive-activated and positive-deactivated quarters.

**Table 3** An example of ML-Ask's output using CVS analysis procedure.

| | **Sentence author's tagging** | **ML-Ask's output** |
|---|---|---|
| *Akiramecha ikenai yo!* (You cannot give up!) | [joy, delight], [excitement] | [joy, delight], [liking, fondness] |

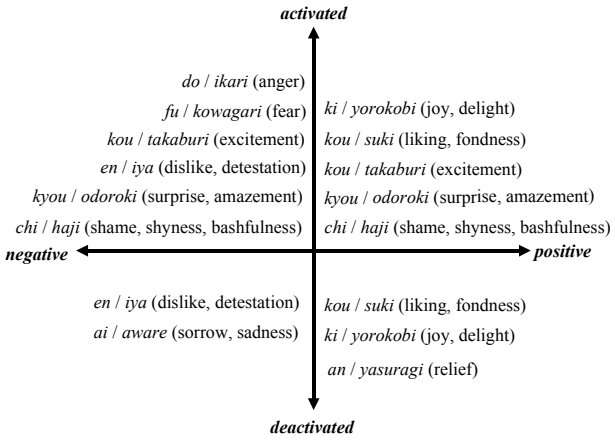


**Figure 2** Grouping Nakamura's classification of emotions on Russell's two-dimensional space.

## 8. Primary Evaluation of ML-Ask

The evaluation experiment performed to verify the system's performance was based on a corpus of natural utterances gathered through an anonymous survey. In the survey participated 30 people from different age and social groups. Each of them was to imagine or remember conversations with persons they know and write three sentences from that conversations: one free, one emotive, and one non-emotive. After that the sentences' authors tagged the utterances written by themselves in the same way, as the system's procedure - first it was determined whether an utterance was emotive. If it was, the specific emotion types were described in emotive utterances. Then the corpus was tagged in the same way by a third party human evaluators (10 people per sentence on average) to determine a general human level in recognizing emotions from text. ML-Ask analyzed this corpus of 90 sentences, and the results of the system were compared to the utterance authors tagging.

### 8.1 Specified Emotion Types

The system can potentially extract multiple emotion types for one utterance. However, some of them can be extracted wrongly, and there is a possibility that there would still be some emotion types not extracted. Therefore the system's results are calculated as the balanced F score with the emotive tags added by the authors of the utterances as a gold standard and emotive tags added by the third party evaluators as a specification of human level in emotion recognition from text in humans.

The conditions for the result to be correct was as follows:

- At least one of the extracted emotive associations belonged to the group of emotion types tagged by the third party evaluators.
- The extracted emotive associations agreed with the majority of the human taggings.

The system's accuracy in estimating the specific types of emotions reached balanced 0.45 of F-score. As for human evaluators, the average accuracy was 0.72. Therefore the system's accuracy reached approximately 63% (0.45/0.72) of the human level.

## 9. Evaluation of ML-Ask with CVS Applied

In the evaluation of the system supported with the CVS analysis procedure ML-Ask was able to determine correctly all of the sentences containing contextual valence shifters. The accuracy of the system raised from 63% to 65.3% (0.47/0.72) of the human level. The improvement is not high, because there were only a few sentences containing CVS structures in the corpus used for evaluation.

## 10. Conclusions

In this paper we proposed a support method for affect analysis of utterances in Japanese. One of the common problems in the keyword-based systems for affect analysis is confusing the valence of emotion types, since the emotive expression keywords are extracted without their grammatical context. To solve this problem we enhanced the emotion types extraction procedure of the ML-Ask baseline system, developed by us before, with grammatical analysis using Contextual Valence Shifters. CVS are grammatical structures including phrases such as "not", "very much" and "not much", which determine the semantic orientation of the valence of emotive expressions. Furthermore, we applied a two-dimensional model of affect to determine which types of emotions are the most probable to appear instead of the contrasted ones. ML-Ask was able to determine all of the sentences containing CVS phrases correctly.

## 11. Future Work

For the future work we plan to evaluate ML-Ask on a larger corpus, including not only the separate utterances, but also a natural dialogue corpus containing emotive taggings. This research is also a step towards a more contextual Affect Analysis and implementing a full scope of Emotional Intelligence Framework proposed by Mayer and Salovey [20]. As the next step in this research we plan to develop a technique for computing the contextual appropriateness of emotion types conveyed in utterances, to which improving the ML-Ask baseline system is a vital point.

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