

THE ROBOTS WITH SOUL AND THE USE OF THE ONTOLOGIES IN THE HUMAN-ROBOT COMMUNICATION

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Abstract: Robots with soul become an important field of robotics and have several issues. An interesting issue is their ability to perceive human emotions differently as the human brain. In order to recognize the human emotions a robot with soul needs to focus on Artificial Intelligence and an Artificial Neural Network, recognizing the words, the languages and the specific patterns and identifying the context and the user’s intention. In this work we propose a robot with soul, which uses an emotional ontology – based Artificial Neural Network, created in Matlab 2019, offering to the humans more privacy, a personalized conversation and a new emotion’s achievement.

Keywords: the robots with soul, Artificial Intelligence, Artificial Neural Network, ontologies.

1. THE ROBOTS WITH SOUL

A robot with „soul” is a humanoid robot that can engage in the human-like conversations. A robot with „soul” is built on Machine Learning/Deep learning algorithms and on a model of Artificial Neural Network and Artificial Intelligence software. In the conversations with a human a robot with “soul” uses a user audio interface and different text, the human emotions and the human voice. A robot with “soul” communicates with a human through the dialogue, recognizes the keywords and the human expressions, understands the context of a speech, deciphers the human emotions and can offer a quasi-human experience.

A humanoid robot is a robot designed to be similar to a human. It has the same basic physical structure and some capabilities of a human. In the future it will resemble people. In this work we present two robots with “soul”, Pepper and Sophia and according to them we create our own robot with “soul” that uses the emotion ontology in the communication with a human.

2. THE ROBOTS WITH SOUL IN THE HUMAN ROBOT COMMUNICATION

The robots with “soul” had been developed a lot in the last decades, but they have only proven useful in the laboratories. Nowadays there are robots with “soul” not expensive and more effective.

2.1. Pepper

Pepper is the first robot with “soul” in the world that can read the human emotions (Fig. 1). He was designed by Softbank Robotics as a personal assistant who observes the environment and acts according to the environment. Pepper is able to recognize the human gestures, the verbal expressions and he can analyze the tone of the human voice to understand his emotions, which allow him to communicate with human in a natural way, including through some “graceful” gestures (<https://www.softbankrobotics.com/emea/en/pepper>).

3.1. The ontologies in the human – robot communication

The ontology in the human-robot communication is a set of the knowledge terms, including the vocabulary, the semantic interconnections and some simple rules of the inference and the logic for some particular topics (Fig.4).

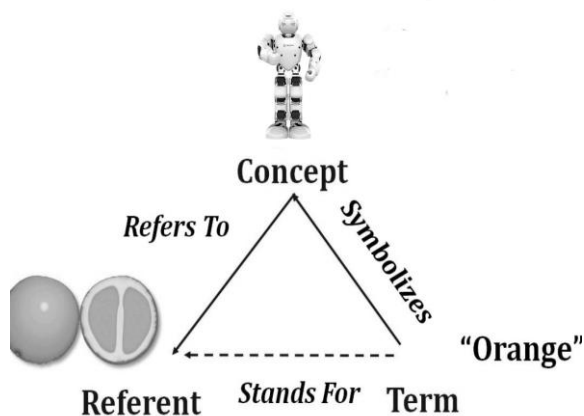


Fig.4. An ontology in the human-robot communication (<https://profs.info.uaic.ro/~busaco/teach/courses/wad/presentations/web09SemanticWeb-Ontologii-OWL.pdf>)

3.2. The emotion ontologies in the human-robot communication

The emotion ontology is the ontology of the affective phenomena such as the emotions, the moods, the appraisals and the subjective feelings, designed to support the human-robot speech. The emotion ontologies cannot be only some scientific terms with a precise definition and include some popular builders. The researchers from the field of the artificial intelligence have the difficult task to discover what a humanoid robot means when he appeals an emotion from the human speech and which the mechanism of his message transmission is. For a humanoid robot it is difficult to express the emotion in one language. In the world there are many languages and each language has different constructions for each emotion, some extremely complicated as a message, as well as the aspect of understanding it.

In our work we propose a classification of the human emotion in the form of the emotion ontology, created in Matlab R2019 (Fig. 5). The proposed ontology has 8 main nodes for each main emotion and each node has 2 or more secondary nodes. The emotion which shows the surprise has two secondary nodes: shocked and astonished.

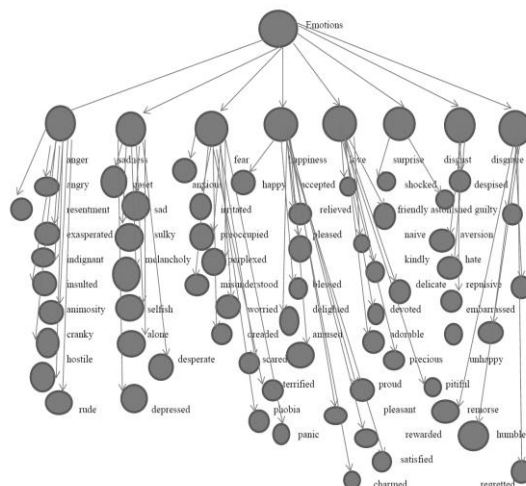


Fig.5. Proposed ontology in the human-robot communication

The main emotions from our work are: anger, sadness, fear, happiness, love, surprise, disgust and disgrace. The secondary emotions for the main emotions of the proposed emotion ontology are:

- anger: angry, resentful, exasperated, indignant, insulted, animosity, cranky, hostile, rude;
- sadness: upset, sad, sulky, melancholy, selfish, alone, desperate, depressed;
- fear: anxious, irritated, preoccupied, perplexed, misunderstood, worried, dreaded, scared, terrified, phobia, panic;
- happiness: happy, relieved, pleased, blessed, delighted, amused, proud, pleasant, rewarded, satisfied, and charmed;
- love: accepted, friendly, naive, kindly, delicate, devoted, adorable, precious, pitiful;
- surprise: shocked, astonished;
- disgust: despised, aversion, hate, repulsive;
- disgrace: guilty, embarrassed, unhappy, remorse, humble, regretted.

4. THE ROBOTS WITH „SOUL” AND THE EMOTION ONTOLOGIES IN THE HUMAN ROBOT COMMUNICATION

In the human–robot communication the robots with “soul” use the emotional ontologies to act and be “alive” as a human. In our work we proposed a robot with “soul” which uses both the proposed emotional ontology and the spectrum of light. For each main emotion from above there is a main color. For each secondary emotion there is a shade of color. We can see it in Fig. 6 and Fig. 7.

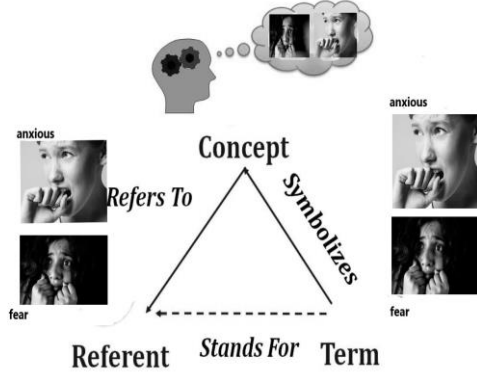


Fig.6. The emotions in the human brain

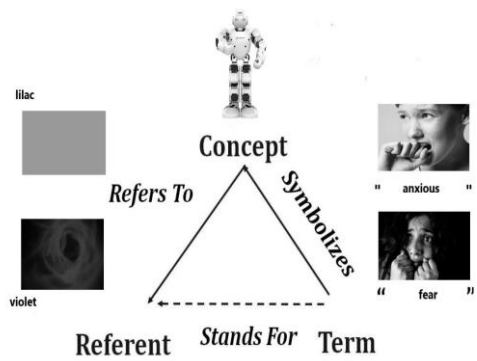


Fig.7. The emotions in the human-robot communication

4.1. The representation of the information in the human-robot communication

In the human-robot communication our emotions are recognized by software based on the fuzzy sets (Fig. 8). The fuzzy sets contain the color frequency (Hz) and each main emotion (Fig. 9). Each color represents an emotion and it has the same color frequency and the same wavelength (for example, the happiness is represented by yellow).

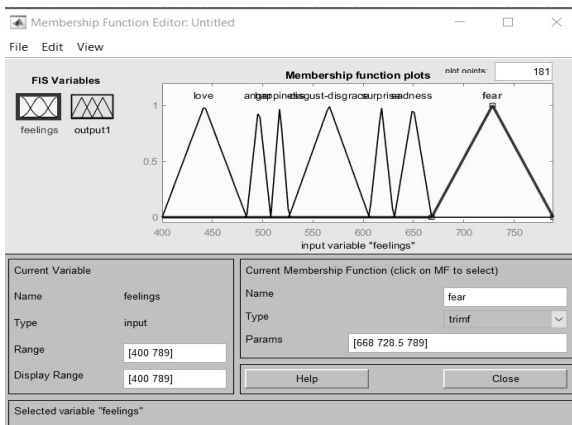


Fig.8. The fuzzy sets with the human emotions

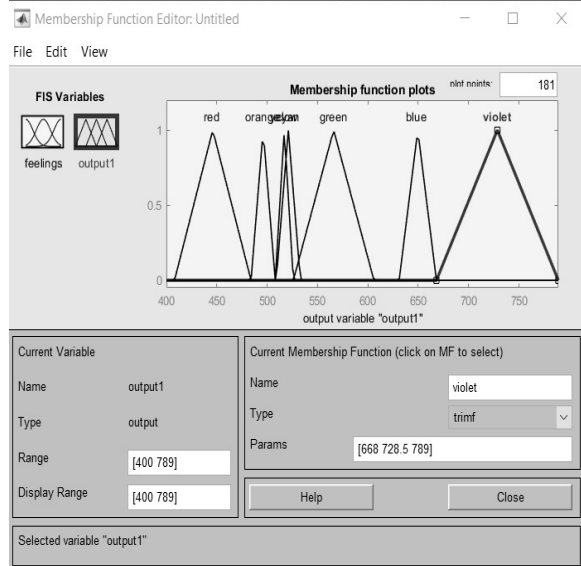


Fig.9. The fuzzy sets with the color frequency for each color.

The colors frequency in Hz used in the human-robot communication is represented in Table 1.

Table 1 The color's frequency used in the human-robot communication

Color	Frequency	Wavelength
Violet	668-789 Hz	380-450 nm
Blue	631-668 Hz	450-475 nm
Cyan	606-630 Hz	476-495 nm
Green	526-606 Hz	495-570 nm
Yellow	508-526 Hz	570-590 nm
Orange	484-508 Hz	590-620 nm
Red	400-484 Hz	620-750 nm

The fuzzy rules of our software are presented in Fig. 10.

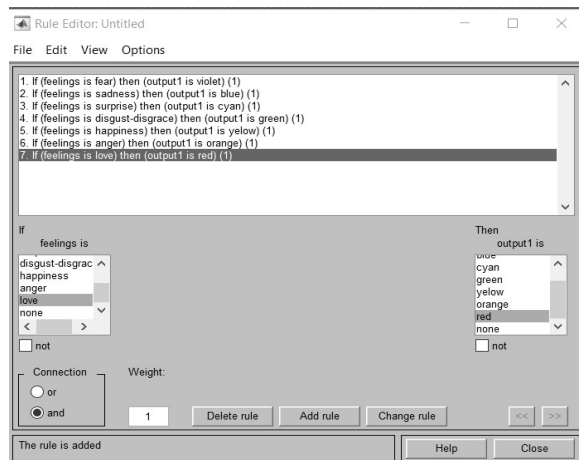


Fig.10. The fuzzy rules of the our proposed software used in human-robot communication

Our proposed emotions depend on how the colors of the light spectrum are perceived by the human and the robot with "soul" when they communicate each other. The humans describe the colors that they perceived using the secondary emotions from our proposed ontology. The robot with „soul” uses the color’s brightness, shade, tint or tone and whether it’s cool or warm toned to express his emotions. Red reflects the feeling of love. The robot with „soul” uses red to stimulate the human body and the human mind and to increase human blood circulation. Orange reflects the feeling of anger. The robot with „soul” uses orange to heal the human lungs and to increase the human energy levels. Yellow reflects the feeling of happiness. The robot with „soul” uses yellow to stimulate the nerves and the purity of the human body. Green reflects the feeling of disgust-disgrace. The robot with “soul” uses green to relieve the human stress and to help him to heal. Cyan reflects the feeling of surprise. The robot with “soul” uses cyan to help the human to be euphoric and to be full of energy. Blue reflects the feeling of sadness. The robot with “soul” uses blue to soothe the human illnesses and to treat the human pain. Violet reflects the feeling of fear. The robot with “soul” uses violet to alleviate human fear.

4.2. The processing of the information in the human-robot communication

The frequency of every audio signal perceived by a humanoid robot in the communication with a human is analyzed and compared with the spectrum of the light. Every color from the spectrum of the light is associated with the fuzzy sets, the colors (Fig.8). The samples of the audio signal from human - humanoid robot communication with the duration of 2-3 seconds are processed and a new spectrum of the frequencies is obtained. The new spectrum of the frequencies is analyzed and is associated with the fuzzy sets, the human emotions (Fig. 9). The human emotions are represented in our proposed ontology and the words in English from our ontology are used to compare the result of the humanoid robot speech recognition from the same samples of the audio signal with our fuzzy sets, the human emotions. If the comparison had a result, the humanoid robot

identifies a secondary human emotion and chooses to alter the color of the main emotion to the specific shade of the secondary emotion, otherwise the humanoid robot chooses the color of the main emotion from our proposed ontology. The humanoid robot uses the fuzzy rules to transform the obtained colors for the human emotions in an audio signal which it is sent back to the human (Fig.10).

5. CONCLUSIONS

The era of the robots with “soul” is started and numerous robots with “soul” are used in the applications developed to assist the humans and the animals. There exist numerous challenges to the humans in the competing with the robots with “soul” and the humans are trying hard to match these types of the robots in speed, perfection and durability as a human. With such performances the robots with “soul” are better and smarter than the humans and can surpass the human in any field. Robots with “soul” can be made highly tolerant, more beauty and more versatile and can be the “mirror image” of a human.

6. REFERENCES

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