UGIVIA: ITADA Project

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The Computer Graphics, Vision, and Artificial Intelligence Group (UGIVIA) is a research unit that belongs to the Mathematics and Computer Science Department at the Universitat de les Illes Balears, in Mallorca, Spain.

The group works in different topics that ranges from Human Motion Analysis and Synthesis, to Advanced Interfaces for disabled users. Some of the projects that the group is currently working on are: SINA (allows disable people to manipulate computer applications using the nose as the mouse), Col.diesis (device that is capable of detecting colour and transforming it into sound), Icar (set of devices implemented in a car to help disabled people to safely drive), PINES (design and development of algorithms for facial and body movements recognition, to be used in natural interfaces), Footmorphing (development of tools that allows the parameterization of the foot shape, so it can be possible to predict its geometry in different conditions, and therefore design a personalized shoe tree), telerehabilitation (facilitate the access of physically disabled persons to rehabilitation treatments based on new technologies, improving their quality of life and their autonomy), and ITADA (implementation of a domotics home assistance system for the elderly and disabled).

The ITADA project is the natural evolution of the finished project INEVAI3D. It includes more functionalities in the following areas: multimodal biometric authentication, complex expressions for avatars, combination of haptics with other visual and sound inputs, advanced agents in charge of controlling the cognitive and emotional layers, and a practical integration in a commercial domotic system. In the area of virtual assistants, it proposes the development of a tangible avatar in a domotics environment, with tele-assistance functionalities in chronic cases of elderly persons. The main tasks include the development and use of TTS-ARS tools, synesthetic systems and their combination in intelligent modules that handle this multimodality, and the creation of an interface for the agent that controls the environment. This interface is represented by a virtual head capable of simulating the emotions and personality of the avatar through facial expressions. To achieve this we have adapted and implemented an affective model that takes into account the events from the environment surrounding the avatar, and translates them into emotions according to their personality and emotional state. The importance of having a virtual character is that it can facilitate the interaction of the user with the system, which is a key aspect in all HCI applications.

The affective model is based on the Pleasure-Arousal-Dominance (PAD) space, which allows the relationship between personality and emotion in the same space. Personality traits (FFM model), are mapped to this space through a set of equations. Elicited emotions are also mapped to specific octants of the space. Their center of mass, *emotional center*, represents their effect on the character in an instant t. The influence of personality over the emotional center is seen as the *actual emotional state*. When the character experiments new emotions, these will be affected by the actual emotional state, generating a *new emotional state*. For visualization of the emotional states, we have used facial expression for emotions associated to the emotional state for its own representation. Emotions can be categorized as universal and intermediate emotions. To generate them we implement an algorithm that uses the standard MPEG-4 and the emotion wheel of Whissell. A facial expression for an emotion is defined by a set of *Facial Animation Parameters* (FAPs), which indicates the movement of the associated *feature points*. To obtain intermediate emotions we used one of two methods: combine two basic emotions, or categorize one basic emotion. As a result, we obtain a set of FAPs with a range of variation for intensities of the emotion. From the obtained results of subjective evaluation and objective evaluation, we concluded that obtained emotional states were coherent to the elicited emotions. In recognition of emotions in images of facial expressions we obtained satisfactory results.

Having an avatar with an expressive face allows the user to feel more comfortable when using the application. The main objective is to achieve a personalized character that goes according to the preferences of the user, and responds coherentely to their demands. Having an artificial intelligence engine behind, the perceptions from and responses to the environment will provide accurately the input needed by the affective model. Also, the standard MPEG-4 satisfied the necessity of a low cost but not very realistic animation. That is why we plan to adapt our affective model and generation of expressions to a mesh handled by muscles. For this task, first we need to map the standard MPEG-4 and the FAPs associated to each expressions to a model of muscles. Then we need to create a very realistic facial mesh that is controlled by muscles. Finally, we have to choose or implement an appropiate engine capable of handling a muscular model.