

VISIC – SOFTWARE PROTOTYPE FOR GENERATION OF MUSIC VISUALIZATION BASED ON HUMAN BODY MOVEMENT/DANCE

VISIC – СОФТУЕРЕН ПРОТОТИП ЗА СЪЗДАВАНЕ НА МУЗИКАЛНА ВИЗУАЛИЗАЦИЯ, ОБВЪРЗАНА С ЧОВЕШКИ ДВИГАТЕЛНИ АКЦИИ/ТАНЦ

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Abstract: This research relates to conceptual software model for synchronization of visual effects and parametrical mapping between audio and visual channels of perception. Software platform serves as a tool for creation of dynamic multimedia by combining roles of listener, dancer and author of composite music visualization. Dance movement is used as universal language for expression of personal interpretation of musical content. Body movement is virtually combined with rhythmical structure of music and dance interpretation is emotionally enhanced by applying various visual effects.

Keywords: MUSIC VISUALIZATION, MULTIMEDIA, PARAMETERES MAPPING, VISUAL FORMS, COMPUTER GENERATED ART.

1. Introduction

Transformation is one of the main approaches used in creating music visualization [1]. Most popular music visualization softwares create attractive visual media which is however far from achieving synergy with music channel just because of lack of model for transforming and adequate mapping of information. Apparent is the need for a new global principle combining both aural and visual channels of perception and in particular – harmony of means of expression.

Current research strives to give proof of human body dance moves, combined with software platform for generating and synchronizing visual effects - VISIC as emotional equivalent to music-art content. For that purpose is needed definition of sustainable model explaining parametrical relations musical-visual which facilitates solving of such creative problems with practical applicability.

2. Preconditions and means for resolving the problem

Main designation of developed software prototype is multiplication of music's emotional impact through perceiving of synchronized visual information for dancing human body. Presented concept is focused on satisfying end users' personal aesthetical preferences. VISIC gives tools which enable user to handle digital video input synchronously with played music sample in real time.

Model used for music visualization is based on hypothesis that alteration of quantitative (parametrical) values in audio and video channel results in augmentation of emotional depth of projected multimedia. Idea for translation of art-emotional content between audio (music) and visual domains which are originally different in physical aspects is inspired by subjectiveness of perception [2].

VISIC substantiates exposed hypothesis for relation between quantitative and qualitative aspects in alteration of parameters of art forms and use of human body as most suitable media for visualizing music. Dance used as an art form serves as a basis for implementing personal emotional interpretation of original music content. That conceptual software platform serves as intellectual assistant on two levels:

A. Parametrical analysis of input music stream

Audio-spectral analysis generates digital equivalent of musical composition. The process is based on FFT transformation and derives data for rhythmical structure of given music piece. Calculated

parameters serve as suitable material for mapping to visual domain in captured dance video input.

B. Visual editor

User is given a platform for visual mapping of video camera input and pre-analyzed dynamic audio parameters. Thus visual equivalent should be defined as author's personal interpretation by setting particular sequence of applied visual filters/effects to captured dance improvisation.

This way is achieved intuitive visualization conformable to aesthetical criterion of author of multimedia visualization. At the same time, due to spectral audio analysis and applied effects on visual channel, parametrical equity between output and input art forms is guaranteed. User controls fairly simple software interface which doesn't demand any advanced skills or specific knowledge in the area of music composition and video-mixing.

3. Решение на проучения проблем

As stated before, VISIC is based on finding correspondence between music content and visual equivalents given by the means of expression of dancing human body. Music spectrum is analyzed by software module. Extracted from played music digital parameters are related to rhythmical structures and can be used by the author as a material for multimedia visualization. Extracted musical data is applied to streaming video input capturing dance moves (Fig. 1). Every selected musical component controls triggering of particular visual effects which are mapped to virtual dancing body.

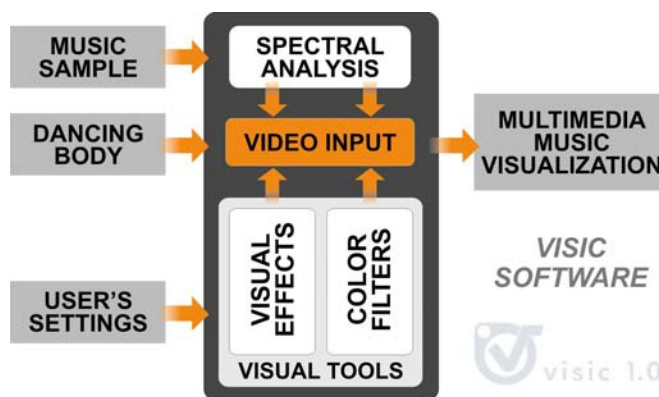


Fig. 1 Structural-functional scheme of VISIC software

Resulting animated imagery created by the real time music stream is highly “sensitive” to dynamic development of music piece. Output visualization reflects music's rhythm as a basic

compositional feature. Tools for applying visual effects combined with dancer's skills make possible creation of unique visual choreography which is rich in figurativeness and dynamically varying color intensity. In very intuitive way output multimedia represents author's emotional interpretation.

When watching dancing body human brain triggers an urge to dance – people are subconsciously associating themselves with dancing figure and spontaneously visualizing music through body movement. Those movements are simultaneous interpretation of music content depending on dancer's aesthetical potential and kinesthetic intelligence. Developed software model implements input sound parameters on such dancing moves, captured in real time by video camera. This algorithm leads to dynamic and organically related to music content output multimedia. Usage of human body as a media for implementation of quantitative musical features results in more intuitive and universally acceptable music visualization. This process consists of three main stages:

1) **Selection of spectral diapason** for extracting music parameters

2) Definition of **visual equivalents** – camera video input, capturing dancing body; adjusting strength of interaction between music and visual channels through varying intensity of applied visual effects.

3) **Mapping** – binding of both channels of perception; selected sound spectrum areas and extracted digital parameters trigger intensity of displaying visual effects. Streamed music is dynamically reflected by strength of visual stimuli applied to virtual graphic environment.

VISIC enables automated processing of real time motion detection and mapping of various classes of visual alterations. Synchronizing music and body motion in generative output multimedia, current software works as instrument for dance-visual game, available for wide segment of customers.

Functional structures of VISIC:

Module 1 – spectral analysis of played music piece

Played audio files are processed in real time streaming analysis. Entire software prototype is build on Adobe's Flash ActionScript3. This module functions based on SoundMixer class of AS3 and controls audio channel features. MP3 file format is played and spectral float is calculated. Main involved method from SoundMixer class is computeSpectrum. It creates visual copy of wave structure of sound and collects normalized curve data in range form -1 to 1. This data is represented by numeric row which is saved in ByteArray temporal structure. FFT(Fast Fourier transform) option of computeSpectrum serves for calculating precise map for audio wave structure (Fig. 2).

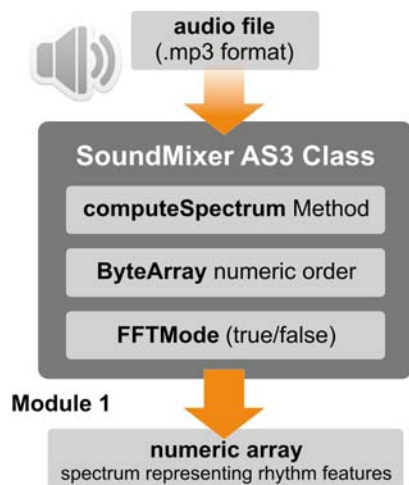


Fig. 2 Algorithm for analysis and computing of played audio files in VISIC

Information extracted from dynamic audio flow is passed to further module for processing by drawSpectrum method which computes graphical equivalents of spectral analysis data. Parameter information for given music piece is collected in byteArray numeric array. Algorithm for analysis of audio file is adapted to select rhythmical structure because it bears main features about tempo, which is fundamental for dance interpretation.

Graphical representation of Module 1 can be seen on Fig. 5 - **Panel A** (Global panel for music channel management).

Module 2 - analysis of input video content and detection of areas with motion

VISIC creates visualization of music content by mapping graphical modifications upon visual objects imported in virtual environment from real world by video camera. Body motions reflect most intuitively music rhythm. This subconscious process is physiologically determined by neural structures in human brain. Presented conceptual prototype has integrated functional module for analysis of input video stream. It serves for isolation (graphical selection) of moving objects from captured area. Areas with detected movement are extracted into separate video layer – ACTIVE. It is represented by bitmap data. The rest of pixels are grouped into other layer – BACKGROUND (area without detected motion).

(A) Active and **(B) Background** layers are virtual medias which are used for applying visual interpretations by users. Those layers are independent areas for implementation of separate visual effects and function with or without applied graphical effects (Fig. 3).

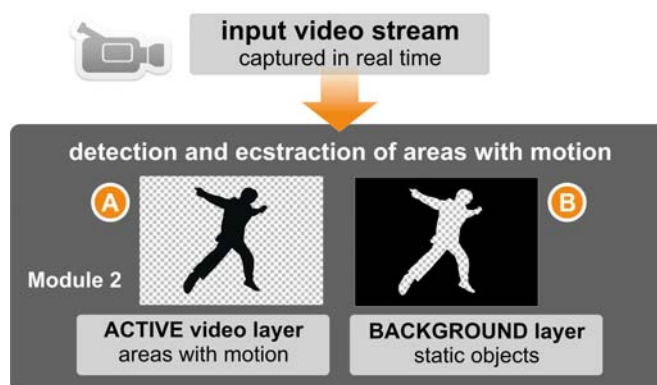


Fig. 3 Visual analysis and fragmentation of video channel into working layers for further manipulation

Control toolbox for managing that module are grouped in Panel B (Fig. 5).

Video stream received by the plugged camera is actually a combination of pixels. Active and Background layers are represented as bitmap objects (structural organization of informational memory for collecting digital images) rendered in real time by AS3 functional class BitmapData.

Module 3 – mapping of audio and visual channels; applying dynamic graphical effects

Extracted data from sound spectral analysis can be handled by user by multiple options for applying them on both ACTIVE and BACKGROUND layers once motion detection module is launched. VISIC offers multimedia working environment which combines in real time streaming information from both sound and visual domains. Module for binding these two channels has tools for creative experiments and enables authors expressing their interpretation of musical content depending on personal preferences (Fig. 4).

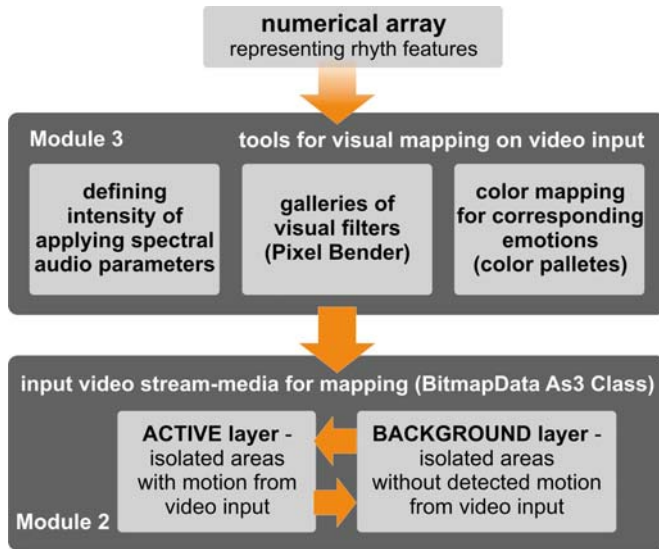


Fig. 4 Algorithm for applying visual effects on video input media in Module 3

Toolbox for controlling that functionalities is represented by panels C, D, E and F as follows: at the bottom of user's interface screen:



Fig. 5 Launch view of VISIC's interface (orange areas depict control areas for managing work process)

C. Panel for controlling ACTIVE LAYER (bitmap area with detected motion);

D. Panel for controlling BACKGROUND LAYER (channel without detected motion);

E. Panel for controlling color tint filtering of ACTIVE and BACKGROUND layers;

F. Panel for user defined emotion – adds global color filter corresponding semantically to chosen emotion;



Fig. 6 Basic videoinput screen view

Fig. 6 demonstrates sample view of captured dance scene without applied any effects. User can see basic video input channel.

Panel A enables selection of music played, speed of play and timeline control. It also gives options for left and right audio channels selection.

Panel B (Fig. 5) tools launch video input motion analysis and extracts moving areas from static background (Fig. 7). They are represented as two work channels which independently can depict streaming visual effects. Result is displayed as dynamic flow of changing imagery superposed upon video input from real world. Options for visual editing are grouped in graphic effects gallery (C, D panels), color filters (E, F panels) and options for changing intensity of every filter applied.

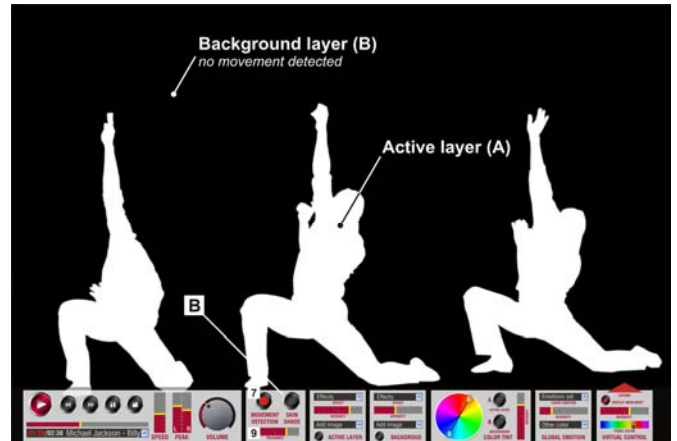


Fig. 7 Bextraction of areas with motion and static areas from real time camera video input

Module 3 combines various visual filters (graphic effects). Depending on input numeric byteArray data from spectrum analysis intensity of effects display varies dynamically and parallel with music. Module 3 implements visualization of graphic effects applied to each layer – ACTIVE and BACKGROUND. Fig. 8 demonstrates dynamic application of effect (selected in panel C) on ACTIVE layer (moving objects are superposed with visual effect pixel area). Scroller tool (11) regulates intensity of manifestation of selected effect. Effect superposition is triggered by analyzed sound parameters.

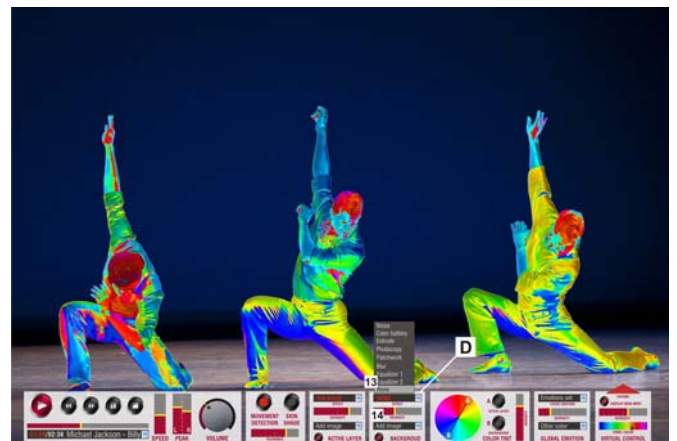


Fig. 8 Applying visual effect on ACTIVE layer

Background area might be excluded from working process and stay neutral during visualization process. Check box at bottom of panel D controls this option. Panels C (ACTIVE LAYER) and D (BACKGROUND LAYER) on fig. 5 enable user as well to import static image from external file. Depending on selected layer this image fills contour area.

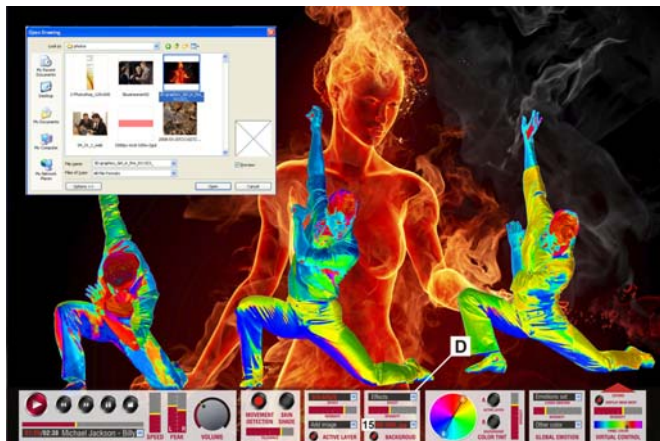


Fig. 9 Visualization of BACKGROUND layer with applied image from file (toolbar 15 on panel D)

That functionality is displayed on fig. 9. Image browsed and imported from file is placed in static area – BACKGROUND layer. It can be changed or removed depending on composition concept, music content and other dynamic components of music visualization.

4. Results and discussion

Actuality and parallel perception of music and its reflected on dancing body components are premise for adequate conveying of content. VISIC is neutral artistic assistant to author of visualization and he is enabled to create his own interpretation of emotional content through dance approach techniques. Resulting visualization is simultaneous and bound to real quantitative dimensions. Animated composite media features real dancing body which is universally acceptable and powerful “instrument” for conveying emotion.

User expresses subjective creative view powered by the virtual environment of VISIC software. Based on his own aesthetical preferences he can manipulate actively the interaction between music and virtual dancing image. Achieved synergy between both aural and visual channels of perception leads to enhanced emotional impact of music through real human body (used as media).

Dance is conceived as interpretation of music content. Developed conceptual software is based on subconscious association of perceiving public with dancing subject and extracted audio parameters find their most adequate reflection on body motion. This approach avoids problem with subjectiveness of perception of art content. Establishment of universal schemes for transfer of information is not appropriate and leads to poor aesthetical results. Therefore VISIC evokes experimental art and offers composite intuitive toolbox to end users. Затова настоящият мултимедиен проект провокира експерименталното творчество на потенциалните си потребители.

5. Conclusion

VISIC's innovativeness is set in the intuitive process of creation of visual interpretation. End user is able to explore process of parallel cognition of music and dynamic video input of dancing body through software tools for manipulation of parametric mapping between these two medias.

Effectiveness of the interaction model: software-user-dancing body is guaranteed by the common nature of used emotional meanings. Human body has established as unique and universal instrument for music visualization during the cultural development of mankind. It combines meanings of expression which are universal for perception and meanwhile integrates semantic information about both art forms – vision and music.

Functional range of presented conceptual project determines creative process of discovering similarities between nature of played music pieces and nature of visual improvisations.

6. Literature

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