Development of Educational Video Data on Neural Network Technologies[1]

**OXANA MESENTSEVA, GERMAN MIHALCHONOK,
OLEG KOLESNITSKIY AND DMITRY KARAULANOV**

Abstract

The material of the paper deals with the results of development and efficient use of educational video materials by the example of neural networks subject. Educational materials are presented as a video-animation film, which deals, engaging and popular, with the fundamental concepts of neural networks technologies: neuron simulation, activation functions, learning paradigms, fields of effective use, etc. Video materials are voiced-over with the option to choose the spoken language (English, Russian, Slovakian and Ukrainian).

Mathematics Subject Classification 2000: 65Y05, 65Y10
General Terms: Educational video materials
Additional Key Words and Phrases: neurons, neuron networks , video material

---

Times when the main source of knowledge was the printed book now are away in the past. Modern teaching materials are more progressive in every aspect as development of techniques, and also information technologies allow to create more evident training courses.

Frequently teaching materials are given to pupils in an electronic form. It can be both a plain text, and specially developed software product. Alongside with a plain text, students have access to various illustrations, video fragments, interactive elements, audio records, etc.   By forces of the international collective of authors video lecture on a theme " Neural networks " had been developed. The given theme is chosen not casually as acquaintance with neural-network aspects of development of an artificial intellect is obligatory by preparation of experts on applied computer science in any country. Students should get acquainted with substantive provisions of the theory of neural networks: structure and properties of artificial neuron and its biological prototype,

---

algorithms of training of neural networks, types and areas of their effective application, prospects of development neural-network technologies.

At creation of modern scientific films opportunities computer schedules are widely used. Development of techniques and technologies today allows to replace the big staff of employees with several teachers - experts on computer the schedule. It became possible owing to use of powerful means of development, such as 3DS MAX, Nero, Adobe Premiere, WaveLab. Development of video lecture " Neural networks " began with a writing of the script since the text of lecture was a basis for the further modelling video samples and their imposing on video paths. After a writing of the script the text was broken into episodes and entered in the table.

Table 1 - Division of the script into episodes

t, c	Name of episode	Scenario text
0	0:35. The transparency slowly vanishes, the middle plan	Cells supporting ability to live. Dendrites - entrance fibres, collect the information from others neurons. Activity in dendrites varies smoothly. Their length is usually no more than 1 mm. The membrane - supports constant structure of cytoplasm inside of a cell, provides carrying out of nervous impulses.
3	0:40.Dendrites light up	
6		
9		
12	0:42. Dendrites die away	
15	0:48. The membrane around of the entire neuron lights up	
18		
21	0:54. The membrane dies away, neuron becomes transparent, the central part lights up	
24		

In the given theme it is necessary to show in details many aspects connected with neural networks which, with the purpose of increase of training effect, it has been decided to present in the evident, fascinating form. With this purpose powerful means on creation of computer 3D-models 3DS MAX has been chosen. 3DS MAX is the

most powerful environment for construction of three-dimensional models of any complexity. The toolkit of the program is very various. The so-called polygonal modelling was applied to modelling the basic objects of film, one of which stages is represented on fig. 1.

Some models were under construction from so-called graphic primitives. On fig. 2 one of such objects - model of artificial neuron is represented. In some cases excessive geometrical complexity does model of less clear, therefore, to abstract from unduly complex elements, were used graphic primitives or their expanded versions.
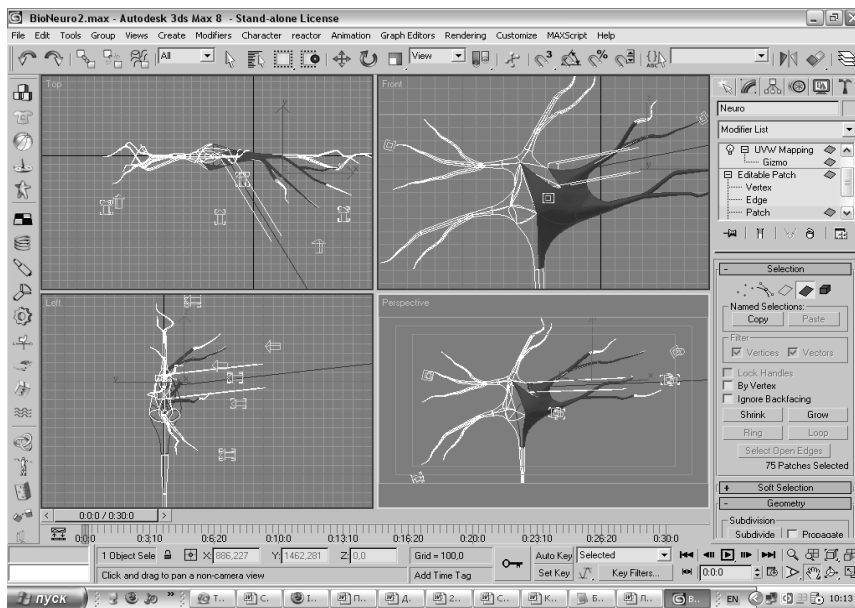

Figure 1 - Process of polygonal neuron modelling.

After creation of all necessary models the following step - animation was carried out. In the given process so-called controllers of animation which are subdivided into two types were used: controllers of the key shots and procedural controllers.Controllers of the key shots are stored by data about animation parameters in the form of keys of animation, that values the parameter during the fixed moments of time. All intermediate values of changeable parameter were counted on the basis of the key staff and the method of interpolation realized by the controller. Various types of the controllers based on keys, data in intervals between the key moments of time differently interpolate.

O. Mezentseva, G. Mihalchonok, O. Kolesnitsky and
D. Karaulanov

Procedural controllers do not store key values of animation parameters, and count target values of parameters on the basis of the initial values entered by the user, and the functional dependence realized by the controller.

Animation by means of the key shots is shown on fig. 3.

After arrangement of chambers and the instruction of ways of animation processing of the image - rendering was made. At rendering the every shot of the image is processed and then, by means of one of the codecs built in system, gathered in a video file. For reception of satisfactory quality the special attention follows was given to the used codec, and also its adjustments. In our case one of the most widespread codecs - DivX was used.
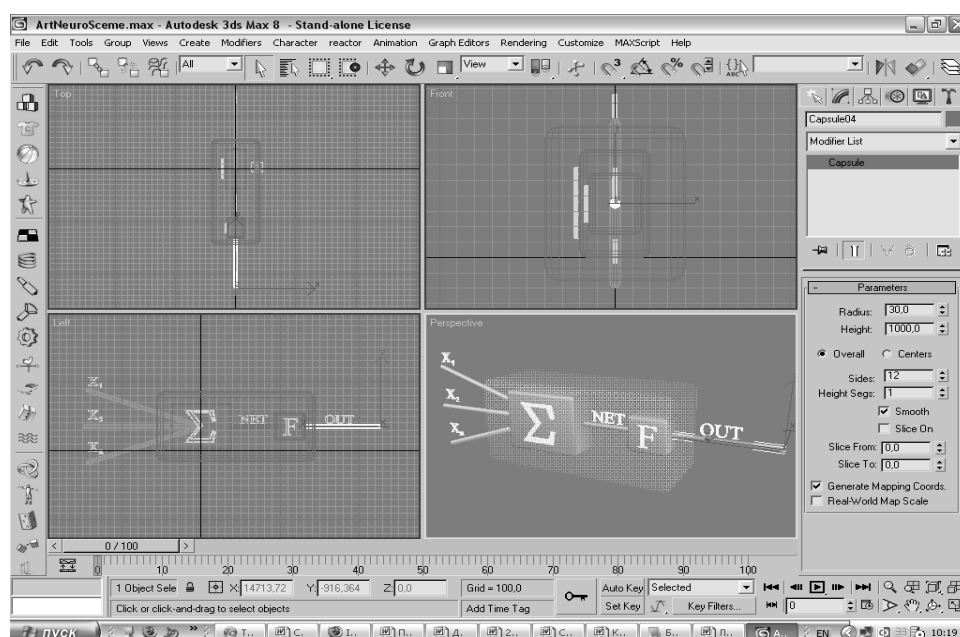
Figure 2 - Process of modelling of graphic primitives

After preservation of models in a video file scoring has been executed. At scoring video lecture " Neural networks " the sheaf of programs WaveLab and Nero was used. Initial record, and also final processing were made in WaveLab. Processing of noise and adjustment of frequencies of an equalizer have been executed in the program entering into package Nero.

Record of a track was made in a monomode with frequency of digitization of 44100 Hz. In the further adjustment of parameters of attenuation, and also force of a sound in decibels here was made.
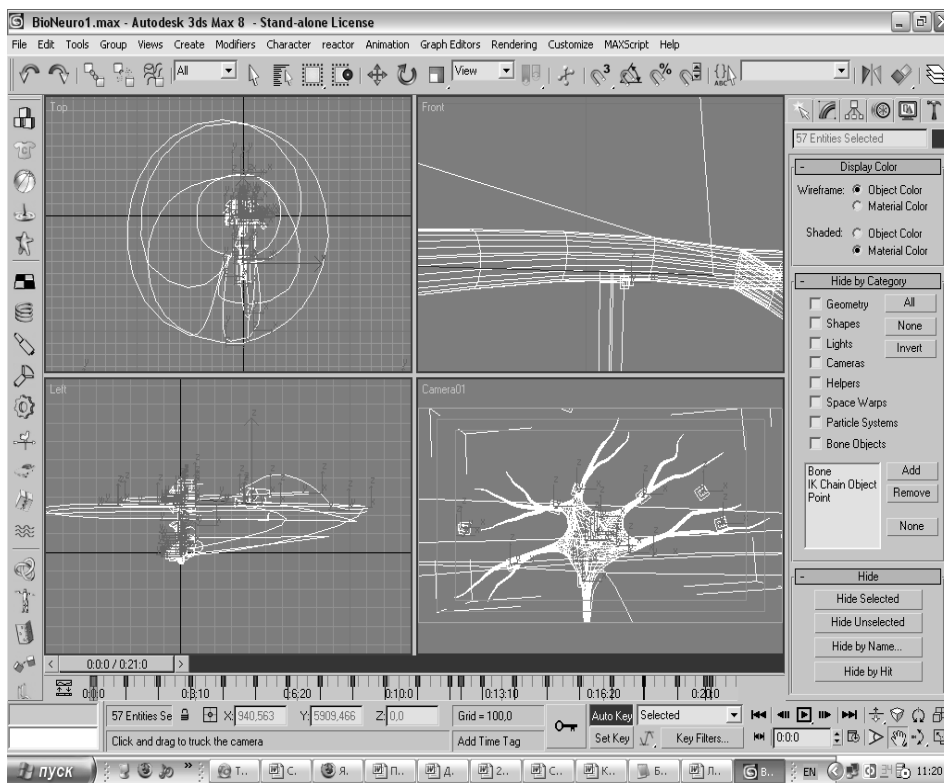
Figure 3 - Animation by means of the key shots

The further processing was carried out in program Nero. In it there are very convenient and intuitively clear means of work with a sound. Here it is possible also, as well as in WaveLab, to write down and edit sounds, however the interface of the program it is focused more on the nonprofessional user, as has served as an tool for secondary processing on sound. In this program updating of frequencies of an equalizer, force of a sound on separate sites have been made, and also the noise-decreasing tool has been applied. Last development cycle of video lecture was nonlinear installation - installation by means of the special equipment (system of nonlinear installation) with an opportunity of change of sequence of the certain shots (fragments) without mentioning other video series. Nonlinear installation as allows to create effects of imposing of the shots, to supplement already mounted video series with effects, credits, a soundtrack.

As the program for nonlinear installation it has been chosen Nero Vision because of simplicity of use and adjustment. The developed video data solves a task in view as evidently illustrates the important positions of the theory of neural networks, and the

197

overwhelming majority of studied concepts is stated evidently by means of animation. Thus the figurative thinking of students develops, the degree of comprehensibility of a material without dependence from a degree of its complexity raises. The video data is clear to the students, who speaks in different languages. And the opportunity of imposing on video of a voice of the lecturer speaking in English, Slovak, Russian, Ukrainian language, only strengthens training effect of video lecture.

Oxana Mesentseva
Department of information systems and technology,
North-Caucasian State Technical University,
Kulakov 2, Stavropol, 355045,
Russian Federation (mos@ncstu.ru)

German Michalchonok
University of SS Cyril and Methodius in Trnava,
J.Herdu 2, Trnava, SK-917 01,
Slovak Republic (german@ucm.sk)

Oleg Kolesnitskiy
Vinnitsa National Technical University,
Chmelnitskoe shosse 95, Vinnitsa, 21021,
Ukraine (okk_vin@mail.ru)

Dmitry Karaulanov
Department of information systems and technology,
North-Caucasian State Technical University,
Kulakov 2, Stavropol, 355045,
Russian Federation (mos@ncstu.ru)