DIGITAL ARCHIVE AND MULTIMEDIA LIBRARY FOR BULGARIAN TRADITIONAL CULTURE AND FOLKLORE

Radoslav Pavlov, Galina Bogdanova, Desislava Paneva-Marinova,
Todor Todorov, Konstantin Rangochev

Abstract: In this paper we present investigation of methods and techniques for digitization and security in digital folklore archive - an archive that consists of unique folklore artifacts stored and annotated in the National center for non-material cultural heritage, Institute of Folklore, Bulgarian Academy of Sciences. The research is separated in several basic aspects. First we investigate techniques for digitization of different multimedia types - text, images, audio and video. We use this research to selected collections of artifacts. Second we describe several methods applied for securing the intellectual property and authors' rights. These include digital watermarking and error-correcting codes. The paper also presents the functional specification, implementation and testing procedures of the Bulgarian folklore digital library, where the digital folklore archive is kept.

Keywords: multimedia digital libraries, digital archive, systems issues, user issues, online information services, watermarking.

ACM Classification Keywords: H.3.5 Online Information Services – Web-based services, H.3.7 Digital Libraries – Collection, Dissemination, System issues, K.6.5 Security and Protection.

Introduction

Information and multimedia technologies that have been developed during the past couple of years introduced new innovative approaches of documentation, maintenance and distribution of the huge amounts of information materials. Preliminary stages start with the content digitization and preservation with proven security methods. After that is the creation of content digital archives and its on-line publication in multimedia digital libraries: environments maintaining diverse hypertext-organized collections of information (digital objects such as text, images, and media objects) organized thematically and managed by complex specialized services for: content structuring, indexing, semantic annotation of digital resources and collections, content grouping, search (semantic-based search, multilayer and personalized search, context-based search), information retrieval, resources and collection management, metadata management, personalization and content adaptivity, multilinguality, content tracking, etc. [Pavlov et al., 2006].

In an attempt to answer the need of wider accessibility and popularization of Bulgarian folklore culture, a team from the Institute of Mathematics and Informatics has developed the "Bulgarian Folklore Heritage" archive and the Bulgarian folklore digital library (BFDL) within the "Knowledge Technologies for Creation of Digital Presentation and Significant Repositories of Folklore Heritage" national research project (Folknow). The "Bulgarian Folklore Heritage" archive aims to present Bulgarian folklore treasure kept in the funds of the Institute for Ethnology and Folklore and Ethnographic Museum (IEFEM) at the Bulgarian Academy of Sciences. The Bulgarian Folklore digital library (BFDL, available at: http://folknow.cc.bas.bg/) represents a complete web-based environment for

registration, documentation, access and exploration of a practically unlimited number of Bulgarian folklore artefacts and specimens digitally included in the "Bulgarian Folklore Heritage" archive.

This paper presents the Folknow project, its vision and ideas. The digitization process and the approaches and tools for building the Bulgarian Folklore archives are included. The paper describes techniques for intellectual property rights digital protection of image and text data in the archive. The paper also presents the functional specification, implementation and testing procedures of the Bulgarian folklore digital library.

Folknow Project Overview

The "Knowledge Technologies for Creation of Digital Presentation and Significant Repositories of Folklore Heritage" project started 6 years ago with fundamental research on contemporary technologies for virtual exposition of intangible cultural heritage. Main project's tasks are the creation of the "Bulgarian Folklore Heritage" archive using Funds of IEFEM at the Bulgarian Academy of Sciences by modern methods of digitization and analysis of selected collections and the release of a prototype of multimedia digital library for the registration, documentation, and access to archive's folklore objects. The digital archive of folk materials is created by knowledge-based technologies of storage, protection and effective access to data in order the modern presentation in a virtual form of valuable artifacts of the Bulgarian folklore heritage. The project aims to give various social applications of the folklore knowledge such as interactive distance learning/self-learning, research activities in the field of Bulgarian traditional culture, and for cultural tourism and ethno-tourism in Bulgaria [Bogdanova et al., 2006].

Digitization process

Digitization or digitize is creation of an object, image, audio, document, or a signal (usually an analog signal) from a discrete set of its points or samples. The result is called "digital image", or more specifically "digital images" of the object and "digital form of the signal. Digitization is the process of creating digital files by converting analog media which can be traditional archival materials (documents, plans, photographs) or three-dimensional objects such as museum artifacts or even works of architecture. Process of transformation of information flows from other types of traditional and digitized. As digitization is a method implementation of new approaches and means to convert some other sources in using information and communication technologies [Project Calimera].

The tasks of digitalization can be synthesized in certain key areas:

- retention of funds and records - many of digitalized objects are fragile or brittle structure is influenced by weather conditions and over time their digitization is the only hope for preservation;
- simultaneous access to materials - most objects are subject to the digitization of rare and unique items of historical past and have a priceless value, the process of digitization will allow more users involved to touch them;
- conservation funds in digital formats - archives, websites, digital libraries. Strengthening international exchange and promotion;
- providing access via computer networks - easy access to digital archives, access to records of persons with disabilities

- provide new opportunities to work with digitalized materials funds - all the functionality is available to users of web space to be copied, multiplied, forwarded, etc., without jeopardizing the its integrity and strength;
- full text search - digital archives organization contributes to easier detection of the searched object among all the crowd, advanced search, unification of search results;
- classification of digital funds via metadata - entire photo meta data wealth funds may be accompanied by important information about copyright, creation date, identification number, etc.

Following advantages of digital libraries can be listed:

- volume density - on one server machine can have the information contained in many conventional libraries;
- accessible - via a computer connected to the Internet, no matter what point of the Earth one has an instant access to desired information;
- quality - regardless of how long certain information stays - it does not change - and the text colors do not fade, the sound is not muted;
- speed - within seconds, minutes can crawl the entire array of data and information needed to remove certain parameters
- security - digital (electronic) data are independent of the medium and within minutes can be transferred to another medium, which makes them physically decoupled from the owner of the information and material damage;
- adequacy - data can be added and changed in the digital library, without stopping or rearrange work and record in real time;
- flexibility - possible structure of the digital archive can be changed without affecting the data and resources;
- simplicity - creating an intuitive and simple interface, work with the digital library will not require specific technical knowledge;
- performance - with minimal effort the user receives the desired information, reports, charts, etc.;
- diversity - the ability to depict different media such as photographs, text, sound and video recordings, three-dimensional images and animation;
- communication - user himself can choose the information he seeks;
- interactivity - an appropriate interface, a variety of information and accessibility of digital library expands the circle of users (children, students, people in difficulty, curious consumers, etc.);
- multitasking - multiple terminals, different users can simultaneously carry out different data operations: view, search, add, update, etc. simultaneously.

Development of digital technology hit the storage and processing of information. Today, almost every unit of information is created digitally: digital photography, digital sound recording, digital communications, text, saved in a file, videos, movies, multimedia presentations stored on digital media, etc. Storage of such digital multimedia

data in digital archives became subject to the same challenges, such as archives, we know before the invention of digital computing devices.

Requirements for the parameters obtained after digitization of objects

Studies conclude that we must work in two directions. Next are given requirements for digitization with priority storage as much information content (left side of the tables) and digitization with priority WEB and network usage (left side of the tables).

TEXT: Text files do not occupy a lot of resources and there are no requirements for size or volume of supporting information. As requirements relating to criteria for accessibility and multiplatform could be specified: cyrillized table of characters is - Unicode, Windows cyrillic 1251 or UTF-8 and use the following file formats: TXT, DOC, PDF, RTF, HTML.

PHOTO: Following parameters to preserve the digital image quality can be used:

File size - from 2 MB to 50 MB Resolution - from 1200x800 px to 6000x4000 px Resolution - 600 dpi to 2000 dpi Number of colors - more than 16 bit color for each RGB channel of the scheme; File formats: BMP, TIFF, PNG or JPG	File size - less than 1 MB Resolution - 800x600 px Resolution - 600 dpi File formats: PNG or JPG

VIDEO: Parameters for digital video recording are:

File formats - A system for streaming video – PAL File size - up to 20 MB Number of frames per second - 25 Resolution of the picture - 720x576 px Ratio of the picture - 4:3 Bitrate - from 2000 Mbps to 4000 Mbps File formats - DVD-Video, DV-AVI, MPG, AVI.	File formats - Stream: MPEG-4, FLV Resolution of the picture - 300x200 px File size - up to 20 MB

AUDIO: To preserve the integrity of auditory information we use the following file format parameters:

File formats – WAV Audio format - PCM; Sample rate - 44 100 Hz Bit resolution - 16 bit; File size - up to 100 MB	File formats –MP3 (MPEG-1 Layer 3) Sample rate - 44 100 Hz Bitrate - from 128 kbps to 320 kbps; File size - up to 10 MB

Initial analysis of the volume in the archives of the National Center for Non-material Cultural Heritage (NCNCH) in IEFEM shows that there are about 10 million text documents, audio – 50 000 hours video – 20 000 hours, 100 000 photo images. It is expected that in the near future the folklore archive will increase the volume of stored information and the number of digital copies. With such a volume of data, following organization of the digital archive is needed:

- Tree file structure;
- Matrix of signature file name;
- META additional textual data for indexing of media files;
- Description for digital archive unit.

In our research we also consider some previous experience in the same area [Bogdanova et al., 2006], [Luchev et al., 2008], [Paneva et al., 2007]. We use several techniques for creation and analysis of digital archive [Boganova et al., 2008a], [Boganova et al., 2008b] [Noev, 2010].

Tree file structure - In selecting the file structure of the organization we keep in mind that the funds hold millions of NCNCH materials cataloged with signatures and future digitization should keep optimized the file organization. We choose the following organization for digitalized artifacts:

- Home folder is "NCNCH IF archive" – ("National Center for Non-material Cultural Heritage, IEFEM, archive");
- Next are folders to individual files, divided by type of media and content, before digitizing them: paper based, photo archive, audio records, video archive and CD archive;
- Next step is a division of media file format (WAV, mp3, AVI, etc.).
- Due to the large number signatures are divided into groups of 100 pcs. in separate folders;
- Next step is a folder for each signature number (archival unit), where digitalized materials can be founded.

Matrix for signatures of file names - For determining the name of files are taken into account:

- Signature numbers in NCNCH funds;
- In media files some information should be listed in brackets;
- Number of digital resource, if there is more than one recording;
- If the name of execution exists, it is written in Latin letters;
- At the end is extension of file format (bmp, jpg, WAV, mp3, AVI, pdf, doc, txt, etc.).

Description for digital data unit - Describing the content of an archival unit, whether digital or not, is essential for organizing the archive. We formulate following text fields as mandatory for description of digital objects from the NCNCH fund: name of the organization that has archive unit (in this case: NCNCH), signature number in the archive, place of recording, date of entry, recorder, theme of the study. And additionally for description of an files: name of the file, parameters of the digital record, date of digitization, underlying digitization, type content of the material.

Establishment of the archive using Fotoware FotoStation - In establishing the digital archive we should keep in mind that it has a tree file structure where all objects are arranged. FotoStation program allows an archive to a multitude of primary and sub directories (see http://www.fotoware.com/en/Products/FotoStation/). The program has built in powerful file editor providing all functions needed for working with files located on a computer system.

Techniques for Intellectual Property Protection in the Bulgarian Folklore Heritage Archive

With the development of digital technologies increasingly part of the audio, video and any other information is available for fast, easy and high quality copying. This fact entails the problem of protecting information from unauthorized distribution. Research in this area is considered in several aspects. One of the most important of these is steganography [Gribunin et al, 2002]. Unlike other subfields such as cryptography, dealing with the concealment of the message itself, steganography tries to hide the fact that the built in message exists. Like steganography, watermark protection, aims carry hidden information but have more resistance against attempts to remove the embedded information. Digital watermark is visible or preferably invisible to the identification code that is permanently embedded into digital data and maintained a presence in them after extracting it [Cox et al, 1997]. Next we describe methods that we used to digitally watermark image, audio and text data in the Bulgarian Folklore Heritage archive.

Methods for image watermarking in the spatial domain

In these methods data are incorporated directly into the original image. The watermark is embedded by changing the illumination or color components. An example of this method is the method of Kutter [Kutter, 1998]. Let s is the bit is that we want to incorporate in the image $I = (R;G;B)$ (color channels; R - red, G - green, B-blue), and $p = (i; j)$ is a pseudo (obtained by the random number generator) position in I. This position depends on the secret key K, which is used as the core for a generator of random numbers. The bit s is embedded by modifying the blue channel B at position p, using illumination $L = 0, 299R + 0,587G + 0, 114B$ by $B_{ij} = B_{ij} + (2s-1)L_{ij}q$, where q is a constant. The value of q is determined so as to achieve the best balance between stability and invisibility. To derive the integrated information we should made an assumption based on a linear combination of pixels around p. To derive the value of the embedded bit is calculated difference between assumed value and actual value of the pixels. The sign of the difference determines the value of the embedded bit. Extracting bits is done without the knowledge of the original message. Sustainability can be improved with the use of a code error correction. The method is robust to filtering, JPEG compression and geometric transformations.

Methods for audio watermarking with amplitude modulation

A basic approach to watermarking is to encode the information into the least-significant bits of the audio data. There are two basic classes of ways to do this: you can replace the lower order bits completely with a PN-sequence, or you can embed a PN-sequence into the existing low-order bitstream. This technique works in the time domain by changing the amplitude of the audio data in a way that can be recovered given the PN-sequence. Variations on this approach include adaptively attenuating the amplitude of the embedded sequence to match the sound level of the current sound passage, and shaping the PN-sequence itself to match the underlying psychoacoustic masking characteristics to further bury the signal.

Methods for text watermarking using encoding by row offset

This is a method, in which lines of text are displaced vertically so that the document can be uniquely encoded [Brassil et al, 1994]. In most cases, the decoding can be performed without the use of the original document, if it is known that the primary document is the same distance between rows. The method is easily noticeable, but resistant to noise.

We use techniques described above to improve security of data in the archive with digital watermarks. As an improvement to these watermarking methods we use error-correcting codes [Baudry et al., 2001]. Because of the specificity of protection with watermark, this problem remains open. Its solution requires the use of code that is as compact and resistant to different types of attacks [Katzenbeisser et al., 2000]. As an improvement to these watermarking methods we use error-correcting codes. We improve performance of the codes by using our own coding method [Berger et al., 2008]. This encoding makes embedded watermarks more resistible to attempts to remove the embedded information.

Functional Specification of the Bulgarian Folklore Digital Library

The Bulgarian Folklore digital library represents a complete web-based environment for registration, documentation, access and exploration of a practically unlimited number of Bulgarian folklore artefacts and specimens digitally included in the "Bulgarian Folklore Heritage" archive. It provides a rich knowledge base for the Bulgarian traditional culture and folklore, enabling its usage for content annotation, preview, complex search, selection, group and management [Paneva-Marinova et al., 2010] [Pavlov et al., 2010] [Paneva-Marinova et al., 2009] [Pavlova-Draganova et al., 2006].

The key for the current release of BFDL is the efficiency and the provision of strictly designed functionalities, powered by a long-term observation of the users' preferences, cognitive goals, and needs, aiming to find an optimal functionality solution for the end users. In BFDL we also follow the requirements of experts in the area of Bulgarian folklore and the accepted functional specification for a digital library. Following them the basic BFDL functional modules are:

- A module for adding and editing folklore objects. For the semantic annotation of the objects in this module is used special ontology describing the Bulgarian folklore domain [Paneva et al., 2007] [Luchev et al., 2008]. The "add object" form expects as an input two types of objects: simple folklore objects and complex folklore objects, strictly specified in the ontology.
- A module for viewing the content of folklore objects (according to their base type and rubric to which they belong or by different descriptive characteristics). Figure 1 shows a snapshot of a folklore object.
- A module for searching by: signature and archive number; keywords of the following categories: name, language, annotation, type of the folklore object/rubric; file type; record information (simultaneously or one by one): by situation, by reporter name, by recorder name, by record date and by recording location; extended search – it provides the option for searching through all the object characteristics;
- A module for managing the user data;
- A module for monitoring the user's actions, which keeps track of the following: a) Actions related to working with the system: registration, logging in the system, unsuccessful log-in attempts, logging out, changing of the user password, e-mail address change, etc.; b) Actions related to the object

manipulation: adding an object, editing an object, deleting an object, adding a file, deleting a file; c) Actions related to the content viewing: review of objects by their characteristics, view of a single object, searching for objects by characteristics; d) Other administrative actions: changing the user's level, deleting a user, generation of an XML copy of the data in the system;

- A module for file format conversion;
- A module for generation of XML copies of the objects in the system.

Figure 1: Folklore Object Preview

The module for viewing the content of folklore objects is available to all users of the library, except the administrators. The reason is that the administrators of such systems are often people who don't have any relation to their content; they only do support tasks. The module itself was implemented similar to the Windows OS file browser and KDE, so that it is closer to the familiar user interfaces for viewing hierarchical information. The left side shows a tree of all classes, which inherit "Type of folklore object", and the right side shows a list of objects of the selected class in the tree.

The module for creating and editing folklore objects is used for adding new objects and modifying the information of already created objects. Through it, one can add more multimedia files to an object or delete existing ones.

Searching for information is the most frequent search and therefore the most important operation in a digital library. This is why there are several modules for searching by different criteria:

- Searching by a signature or archive number – This search module is useful for finding objects by their archive number (for example, AIF No 200, folder 1, page 57). In general, there is only one search result. In case of incorrect data, it is possible to have several objects as a result.
- Search by a keyword in the object properties – by name, language, annotation and type of the folklore object – Searching is performed simultaneously over all these properties. It is expected that this module is the most frequently used one. This is why special attention has been paid to its optimization.

- Searching by record information – This module is used to find all the objects which cover some of the following conditions: all the objects recorded in a given situation, for example an interview, chat/conversation, etc.; all the objects recorded by a given person; all the objects recorded by a given informer; all the objects recorded in a given period of time; all the objects recorded in a given location.
- Searching by file type – This module allows getting a list of all the objects to which there is a multimedia file attached – audio, video or images. This type of searching uses the database in which the administrative information is stored instead of the OWL file that contains the ontology.
- Complex search on all fields semantically describing the folklore object. Using this search simple and complex folklore objects could be found, tracking their semantic metadata records.

Most types of searching use SPARQL (SPARQL Protocol and RDF Query Language). This is a language for requests to the RDF and OWL ontologies. The language is in a standardization process by RDF Data Access Working Group as an official recommendation of the World Wide Web Consortium. The SPARQL syntax is similar to the most widespread language for database requests – SQL.

The module for monitoring the user's actions is intended to keep logs of the objects modified and deleted by the users, so that in case of data deleted by mistake or entered wrongly, the responsible user can be found. There is also a log of search requests, whose purpose is to enable statistical reports about the search types that are used least and most often. It would allow the removal of the rarely used search types and the priority optimization of the ones that are used most often.

The module for file format conversion was developed to provide the ability to present every file which is unsuitable for internet preview in a "light" and convenient form for web preview. The module recognizes the "inconvenient" files, tries to covert them and on success replaces the original file with the new "lighter" file; on failure, the module keeps the original file in the library. The module for generating an XML copy of the data is available only to the system administrators. The purpose behind this module is creating a copy, which can be used as an archive copy on one hand and on the other hand it may serve as raw data for other systems using information from the library.

The presented BFDL functionality aims to serve a wide range of users – specialist and non-specialist. The group of specialists is composed by scientists who study Bulgarian folklore professionally and search for specialized information on the observed folklore objects. The group of non-specialists has interests and wants only to learn more about the classical Bulgarian folklore objects. The BFDL system supports several users' levels: administrators, folklore content editors, specialist viewers and non-specialists viewers. Their individual characteristics, needs, interests, motivation, and preferences are discussed in [Pavlov et al., 2006].

Implementation of the Bulgarian Folklore Digital Library

The implementation specifics of the functional modules of the BFDL are the following:

A module for adding objects to the BFDL – Adding objects is implemented through filling and sending a form to the web server. Because of the great number of fields to fill, the form is not generated completely. Only the fields necessary for the creation of the objects are generated, following the semantic descriptions presented in the BFO, built at the first stage of module 3 of the project. The technology used for the implementation is AJAX. The

user interface passes a request to the server, in which it requires only that part of the form which according to the user is necessary to create the object. The server processes the request and returns the required fields as a result, which is visualized in the user interface. After all the fields are filled, the user submits the form. The server validates the data and if everything is correct, it adds the object to the data storage. If there is something wrong, it returns a message to the user, relative with the error (usually, an empty field or unacceptable field value). After the server adds the information from the form to the data storage, there follows a check for attached files in the user request. If there are attached files, the server checks if there are file formats which are unsuitable for web presentation (for example, wav, .doc, .mpg, .avi, .mpeg, etc.) and if it finds such files, the system refers to the module for file format conversion to formats suitable for web preview. For each of these files, the module for file format conversion tries to convert them. Upon success, it adds the converted file to the library. On failure (which can occur if the added file has any specifics which the system cannot recognize), it adds the original file to the library. At the end of the object adding procedure, the system refers to the module for monitoring the user actions, where it adds an "object added" event and records the author (the user who created the object) and the event date.

A module for editing objects in a BFDL – The module for editing objects works almost in the same way as the module for adding objects. The difference is that the system doesn't add information about a new object, but replaces the existing information about an object with the new information, provided by the module for editing. Again, the system checks the form for errors, processes the files (if there are new files added), changes its data and finally adds an event for modified object through the module for monitoring the user's activity.

A module for viewing the content of folklore objects – This module takes a request from a user, in which the user specifies the property by which a folklore objects must be found. The module refers to the data storage and makes a request for selecting and sorting the objects by this property. The module for monitoring the users' actions records the "view objects by" event and adds data about the date, the user and the property by which objects are listed. The storage processes the request and returns a result, which the system processes and sends to the user. The user interface visualizes the result in a proper manner.

A module for searching – This module allows the user to set a property or properties by which objects are found. The following algorithms are used:

The algorithm for searching by a single property – The user interface sends a request to the data server specifying the property and its needed value. The module for searching refers to the data storage of semantic metadata with a query for selection and sorting the objects with the needed value of the specified property. The module for monitoring the user actions records the "search" event with the provided search parameters, the date and the user, who performs the search. The storage processes the request and returns a result, which is then processed by the search module and displayed in a proper manner by the user interface.

The algorithm for searching by more than a single property – The algorithm is parallel to the one described above, with the only difference that the query to the data storage is more complicated – there are multiple selections of objects for each search property and the result is a sorted section of the selection results.

After an analysis of the means and standards in the technological implementation of the library environment and the functional modules, the following software was chosen: Operating system: Microsoft Windows Server 2008 x64 Standard; Web server: Apache HTTP Server v 2.2, PHP v 2.2.9; Database management system: MySQL v

5.1 Standard; Tools for the additional modules: FFMPEG, vwWare, HTML, JavaScript, AJAX; Database query language: SPARQL.

Testing Procedures in the Bulgarian Folklore Digital Library

The functional components of the architecture of the BFDL were implemented and tested for errors and speed on a server platform with the following hardware configuration: CPU: 2 x Intel QuadCore 2.8 GHz; RAM: 8GB DDR3; HDD: 4 x 500GB, RAID 10 SATA II; LAN: 2 x 1000Mbit.

Testing the functional module for adding/editing a folklore object – Server response time (average of 50 attempts): 0.0058 s, i.e. in theory the functional module for adding/editing an object can process about 172 requests per second for each processor core, which makes 172*8=1376 requests.

Testing the module for viewing folklore objects – Time for server response: 0.009 seconds per request, i.e. 888 requests per second.

Testing the module for searching by a single property – Time for server response: 0.008 seconds per query, i.e. 1000 requests per second.

Testing the module for searching by several properties – The test was performed with 25 properties (it will happen very rarely). Time for server response: 0.01 seconds per query, i.e. 800 requests per second.

Testing the module for file format conversion – Converting video files: the server sends a response before it converts the video file, because the process is relatively slow. The average time of processing a video file is about 30 seconds, i.e. you can add about 16 video objects per minute. In this way, after adding a video object, its actual recording in the BFDL happens in 30 seconds.

Converting audio files – The server responds before the file is actually processed. The average time for processing an audio file is about 10 seconds, i.e. in theory a system with such a configuration can process about 48 audio files per minute.

Converting MS Word (.doc) files – The conversion takes place in real time. The average server response time is 0.04 seconds per request, which are about 200 requests per second.

Conclusion and Future Work

Digitizing and presenting our traditional culture and folklore in virtual exposition through digital libraries we enable "any citizen to access human knowledge anytime and anywhere, in a friendly, multi-modal, efficient, and affective way, by overcoming barriers of distance, language, and culture and by using multiple Internet-connected devices" [Brainstorming report, 2001]. Moreover, during the presented project we give various innovative social applications of the folklore knowledge: interactive distance learning/self-learning, research activities in the field of Bulgarian traditional culture, cultural tourism and ethno-tourism in Bulgaria, dissemination of the national folklore treasure through social networks, etc.

During the last project year the work continues with the development of a Bulgarian folklore information artery, providing ability for users to collaborate and interact with each other in a dynamic, user-centred environment, maintaining social media dialogue in the folklore domain.

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Bibliography

[Baudry et al., 2001] Baudry, S., Delaigle, J.F., Sankur, B., Macq, B., Maitre, H., Analyses of Error Correction Strategies for Typical Communication Channels in Watermarking. Signal Processing, pp. 1239-1250, 2001.

[Berger et al., 2008] Berger, T., Todorov, T., Improving the Watermarking Process with Usage of Block Error-Correcting Codes. Serdica Journal of Computing, 2008, Vol. 2, pp. 163-180.

[Bogdanova et al., 2006] Bogdanova, G., Pavlov, R., Todorov, G., Mateeva, V., Technologies for Creation of Digital Presentation and Significant Repositories of Folklore Heritage. Advances in Bulgarian Science Knowledge, National Center for Information and Documentation, 2006, Vol. 3, pp. 7-15.

[Bogdanova et al., 2008a] Bogdanova, G., Georgieva, Ts., Using Error-correcting Dependencies for Collaborative Filtering. Data and Knowledge, 2008, Vol. 66, Number 3, Elsevier.

[Bogdanova et al., 2008b] Bogdanova, G., Todorov, T., Georgieva, Ts., New Approaches for Development, Analyzing and Security of Multimedia Archive of Folklore Objects. Computer Science Journal of Moldova, 2008, 16, 2(47), pp. 183-208.

[Brainstorming report, 2001] Digital Libraries: The Future Directions for European Research Programme, Brainstorming Report, San Casioano, Italy, 2001.

[Brassil et al, 1994] Brassil, J., Low, S., Maxemchuk, N., O'Gorman, L., Electronic Marking and Identification Techniques to Discourage Document Copying. In the Proceedings of IEEE INFOCOM '94, 1994, Vol. 3, pp. 1278-1287.

[Cox et al, 1997] Cox, I., Kilian, J., Leighton, T., Shamoon, G., Secure spread spectrum watermarking for multimedia. In Proceedings of the IEEE International Conference on Image Processing, 6, 1997.

[Gribunin et al, 2002] Gribunin, G., Okov, I., Turincev, I., Cifrovaia Steganographia. Solon-Press, 2002.

[Katzenbeisser et al., 2000] Katzenbeisser, S., Peticolas, F., Information Hiding Techniques for Steganography and Digital Watermarking. Artech House, 2000.

[Kutter, 1998] Kutter, M., Digital Signature of Color Images Using Amplitude Modulation. Journal of Electronic Imaging, 1998, pp. 326-332.

[Luchev et al., 2008] Luchev, D., Paneva, D., Rangochev, K., Use of Knowledge Technologies for Presentation of Bulgarian Folklore Heritage Semantics. International Journal Information Technologies and Knowledge, Vol. 2, Number 4, 2008, pp. 307-313.

[Noev, 2010] N. Noev, Organization and Security of the Audio and Video Archive for Unique Bulgarian Bells, Mathematica Balkanica, NewSeries Vol. 24, 2010, Fasc.3-4, 2010, pp. 285-291.

[Paneva et al., 2007] Paneva, D., Rangochev, K., Luchev, D., Knowledge Technologies for Description of the Semantics of the Bulgarian Folklore Heritage. In the Proceedings of the Fifth International Conference Information Research and Applications i.Tech, Varna, Bulgaria, 2007, Vol. 1, pp. 19-25.

[Paneva-Marinova et al., 2010] Paneva-Marinova, D., Pavlov, R., Rangochev, K., Digital Library for Bulgarian Traditional Culture and Folklore, In the Proceedings of the 3rd International Conference dedicated on Digital Heritage (EuroMed 2010), 8-13 November 2010, Lymassol, Cyprus, Published by ARCHAEOLINGUA , pp. 167-172.

[Paneva-Marnova et al., 2009] Paneva-Marnova, D., Pavlov, R., Rangochev, K., Luchev, D., Goynov, M., Toward an Innovative Presentation and Creative Usage of the Bulgarian Folklore Wealth, International Journal „Information Technologies & Knowledge", Vol. 3, Number 1, 2009, pp. 56-66.

[Pavlov et al., 2006] Pavlov, R., Paneva, D., Toward Ubiquitous Learning Application of Digital Libraries with Multimedia Content, Cybernetics and Information Technologies, 2006, Vol. 6, Number 3, pp. 51-62.

[Pavlov et al., 2010] Pavlov, R., Paneva-Marinova, D., Rangochev, K., Goynov, M., Luchev, D., Towards Online Accessibility of Valuable Phenomena of the Bulgarian Folklore Heritage, In the Proceedings of the International Conference on Computer Systems and Technologies (CompSysTech'10), June, 2010, Sofia, Bulgaria, ACM ICPS Vol. 471, pp. 329-334.

[Pavlova-Draganova et al., 2006] Pavlova-Draganova L., Georgiev V., Draganov L., Virtual Encyclopaedia of the Bulgarian Iconography, In the Proceedings of Modern eLearning Conference, Varna, Bulgaria, 1 - 5 July, 2006, pp. 165 – 170.

[Project Calimera] Project Calimera - www.lib.bg/proekti/CalimeraSummaryBG.doc

Authors' Information

Radoslav Pavlov – PhD in Mathematics, Associated Professor, Institute of Mathematics and Informatics, BAS, Acad. G. Bonchev Str., bl. 8, Sofia 1113, Bulgaria; e-mail: radko@cc.bas.bg

Major Fields of Scientific Research: Multimedia and Language Technologies, Digital Libraries, Information Society Technologies, e-Learning, Theoretical Computer Science, Computational Linguistics, Algorithmic, Artificial Intelligence and Knowledge Technologies.

Galina Bogdanova – PhD in Informatics, Associated Professor, Institute of Mathematics and Informatics, BAS, Acad. G. Bonchev Str., bl. 8, Sofia 1113, Bulgaria; e-mail: galina@math.bas.bg

Major Fields of Scientific Research: Information Society Technologies, Multimedia Digital Archives, Data Mining, Information Society Technologies, Steganographia, Coding Theory, Computer Science, Algorithms, Knowledge Technologies and Applications.

Desislava Paneva-Marinova – PhD in Informatics, Assistant Professor, Institute of Mathematics and Informatics, BAS, Acad. G. Bonchev Str., bl. 8, Sofia 1113, Bulgaria; e-mail: dessi@cc.bas.bg

Major Fields of Scientific Research: Multimedia Digital Libraries, Personalization and Content Adaptivity, eLearning Systems and Standards, Knowledge Technologies and Applications.

Todor Todorov – PhD in Informatics, Assistant Professor, Institute of Mathematics and Informatics, BAS, Acad. G. Bonchev Str., bl. 8, Sofia 1113, Bulgaria; e-mail: todor@math.bas.bg

Major Fields of Scientific Research: Coding theory, Steganography, Watermarking, Multimedia Digital Archives, Databases, Data Mining.

Konstantin Rangochev – PhD in Philology, Assistant Professor, Institute of Mathematics and Informatics, BAS, Acad. G. Bonchev Str., bl. 8, Sofia 1113, Bulgaria; e-mail: krangochev@yahoo.com

Major Fields of Scientific Research: Ethnology, Folklore studies, Culture Anthropology, Linguistics, Computational Linguistics, Digital Libraries.