Knowledge Base for the Course of Digital Photography

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Abstract: - The objective of the paper is to describe a knowledge base for the course of Digital Photography that is developed at the Faculty of Informatics and Management, University of Hradec Králové. We want to integrate different resources about photography using the web-based repository and to enable browsing and searching resources not only with respect to learning objectives of the particular lesson, but also with respect to needs and interests of individuals. In this paper we highlight different types of knowledge that has to be involved in the knowledge base.

Key-Words: - digital photography, course, knowledge resources, knowledge modeling, ontologies, Topic Maps

1 Introduction

The area of digital photography is now really attractive and accessible for everyone due to the availability of digital cameras, from the simplest cameras integrated in mobile phones to professional DSLRs, and related equipment such as film scanners, special kinds of lenses, photo editing software, high quality printers, web-based photo galleries and social networks such as Facebook etc.

For the beginner, it is quite difficult to orientate oneself in plenty of information about digital photography and to form opinion. In correspondence with the rapid development of technologies and the large amount of (online) resources on photography it is not easy to recognize valid and reliable information.

In certain aspects such as composition rules, up-to-date web pages dedicated to “dummies” are not always as valuable as books over 50 years old, written by renowned authors. But the problem is that for all amateurs in general and for students especially, accessing e.g. Wikipedia is much easier and more natural than searching for old books in public libraries. Moreover, some information about classical photographic techniques that were published dozen years ago cannot be directly applied today because the same ingredients are not available, or simply because things works differently (e.g. manipulation with old-fashioned baryta paper versus today’s RC paper is different). Therefore some knowledge from old books – after being located – can be reused directly, while other recommendations have to be examined critically and adopted to current circumstances.

The impact of online discussions of amateurs is significantly higher in comparison with up-to-date books and journals simply because web discussions are accessible so easily to everyone. Misunderstanding and rumour can spread quickly there.

Finding specialized information on the web is still difficult, especially when the user is not able to express his or her need by proper keywords.

People differ in their relationship to the photography – some of them focus mainly on technical parameters of cameras and pictures, trying to measure how precisely the pictures correspond to real scenes or models. Others are fond of editing software and Photoshop tricks. Others love the process of taking pictures itself without being interested in results, and others do not take own pictures at all but admire exhibitions and publications of professionals.

These and other incentives made us to think of modeling knowledge about photography and creating the repository of resources. Because of the wideness of the domain of photography, the range of approaches, the inconsistency of opinions, the abundance of resources etc., the knowledge modeling in domain of photography means a great challenge.

2 Course of Digital Photography

In this contribution we describe the process of knowledge modeling for the purpose of the course of Digital Photography at the Faculty of Informatics and Management, University of Hradec Králové. The course is facultative, the lecture takes 1 hour and exercises take 2 hours a week. The course is attended by students of Information Management, Applied informatics and Management in Tourism. In lectures students learn the theory (history of photography, parts of the digital camera and its usage, genres of photography, artistic composition, famous Czech and foreign photographers etc.). During practical exercises in the computer lab, students learn to use software, namely to edit photos in Zoner PhotoStudio [14] (Czech editor, a bit simpler than Adobe Photoshop), to process RAW format in Adobe Lightroom [1] and to create HDR images using Photomatix [15]. Students are taught both to read photos

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and to understand them, and to manipulate photos in editing software. The phase of taking pictures is behind the scope of the course because of time and technical limits. (In exercises, students can work with their image files, or with files prepared by tutors.) The books on photography are available in the university library and students are asked to use them, and they are motivated to notice photos in printed media and think of them – the assignments are defined that help students to focus on particular aspects of photography.

2.1 Image resources

Naturally, the best way how to learn to understand photography is to watch a lot of photos. Therefore the study materials involve numerous photos, organized in collections, described by metadata and used appropriately in lectures and exercises. It is important to notice that each photo can be reused in several contexts, e.g. the same picture works as an example of:

- utilization of wide-angle lens,
- impressive color contrast,
- work of some famous photographer etc.

Therefore one photo can be used in three different lectures. The usage of same photos many times would make the course a bit boring, of course. It is necessary to have got several examples of particular concept or technique and mix them. More examples help students to better understand the topic, but the more examples we have, the better organization of resources is demanded.

Sometimes it is necessary to have got couples of positive and negative examples of the same topic, e.g. the correct usage of the golden ratio principle and (nearly) the same photo representing other than golden ratio composition, or sets of alternatives, e.g. portraits of a child or animal from different viewpoints (top view, bottom view, face to face view).

For understanding topics such as pictorial news, photojournalism or documentary the collections of dozens photos have to be used, because single photo cannot exemplify the principle. Similarly the explanation of variable approaches of different authors, explanation of differences between genres of photography, or illustrating typical photo production in particular age epoch have to be accompanied with sets of pictures.

It is clear that image resources are important for the course and especially their organization and metadata description have to be sophisticated.

2.2 Organization of learning resources

To obtain photos for the course of photography, tutors can either search for suitable sample photos in books, journals, magazines, web galleries and presentations of photographers, or they can create their own pictures. Having appropriate photos for all lectures and exercises, it is necessary to manage photos and find the best way how to present them to students.

At FIM UHK, most courses are accompanied with electronic learning materials presented through e-courses inside the WebCT learning management system [13]. It is possible to store photos there, either in Learning Modules, or in Media Library. The external online resources such as web presentation of photographers can be enlisted in Web-links, and books and printed journals can be enumerated in the list recommended reading. If the tutor wanted to present photos in lectures, he or she has to prepare PowerPoint presentation with photos inserted. The solution is not too flexible and we looked for alternative approaches. Especially we asked for supporting multiple categorizations according different axes, such as:

- authors of photos,
- genre categories (abstract, architecture, technical, nature, animals, people, portraits, macro, close-up, landscape, panorama, life, document, photojournalism, travel, night shooting etc.),
- general technical categories (pinhole and digital pin-hole, scanned negatives, black and white photo, color photo, creative effects, utilization of filters, multiple exposure etc.),
- particular technical aspects (white balancing, ISO sensitivity, image quality, aperture setting, shutter setting etc.),
- particular composition principles and rules (background, color, framing, leading lines, patterns, perspective, space, symmetry, viewpoint etc.).

Also it is important to interlink pairs or collections of photos and mark up positive and negative examples of the given term or category, mark up order of photos in sets and collections.

Moreover, it is necessary to express relationships among terms on the same axis (e.g. both the aperture and shutter are technical parameters while both panorama and portrait are genres).

Finally, it is important to differentiate between several meanings of the same term, e.g. that the minimum value of aperture relates to lens opening as well as to the usability of the lens for portraying or for dark light conditions, that the value of aperture relates to the shutter times etc. Such complex modeling of relationship among concepts exceeds possibilities of WebCT learning management system, which is intended to be more the content management system than knowledge repository.

Therefore instead of WebCT e-course, we decided to apply ontologies and we think of the Topic Maps standard for integration of learning materials and
organizing photos with respect to numerous features and properties that were caught in the domain ontology. Similar solution, with the emphasis on integration of learning resources of different e-courses, was presented in [7, 8].

2.3 Types of Rules in Photography

Except concepts and relations, the course of Digital Photography has to present numerous principles, rules and guidelines that were defined by photographers and theorists. The rules are more or less strict and it is equally important to know them and to be able to relax them. Some rules are well known and are valid in all types of visual art, e.g.:

- The rule of thirds says how we can enhance the impact of the scene by positioning important elements along horizontal and vertical lines that divide the image into nine equal segments.
- The rule of cropping recommends eliminating all subjects that are not relevant but that get viewer's undivided attention.
- The rule of balancing notes that it is important whether the mutual positioning elements in a frame are balanced or unbalanced.

Other rules and recommendations are specific for the photography, either in relation to the technical equipment, or in relation to differences between perception of photos and perception of other kind of visual information. These principles explain how our eyes and brains differ from the camera functioning, e.g.:

- The depth of field control on the photo can be chosen exactly, while our eye is continuously scanning the scene and we cannot made us to see the sharp object in front of the blurred background.
- The dynamic range of photo is limited in comparison with our eyes. We can recognize the details inside the room and outside the window at the same time, but the camera takes either the interior too dark or the exterior too light, so achieving higher dynamic range is object of special tricks.
- We tend to believe what we see. Although people know well that photos can be edited, they often prefer believing that something curious really happened rather than that the photo was manipulated.

Last, but not least, there are inspiring rules such as 10 golden rules of lomography [4] (e.g. take your lomo anywhere you go, be fast etc.) or statements of good teachers of photography, such as the sentence recycle bin is the best friend of beginner [11]. These rules are totally different from technical rules, but all types of rules are worthy in some way and should be involved in the learning materials and therefore should be modeled in the knowledge base.

2.4 Workflow of Photographing

Concepts, relations, and rules represent atomic knowledge items of the course content, but there are also global objectives that have to be taken into account. The top level objective of the course is to analyze and explain three general steps of creating photos: the phase of planning, the phase of taking picture and the phase of post processing. All these phases are equally important.

Billions of existing photos persuade us that everything is already there. Watching a lot of photos helps the learner to understand styles of various authors, it stimulates the imagination of individuals and it influences their good taste and preferences. Experiments with old-fashioned techniques such as pinhole or photogram enhance the creativity too. The course content has to present the alternative techniques in form of guidelines (e.g. how to create a digital pinhole by making the hole in the capping of the camera body), accompanied with relevant images and schemas.

The phase of taking photos and the phase of post processing are complementary in sense that certain (but not all) mistakes of the photographer can be repaired by editing the photo. Naturally, it is better to minimize the amount of post-processing work by precise control of the photographing phase. In relation to taking photos, the principles of different photographic genres have to be explained step by step, or enlighten on case studies (from e.g. general rules of landscape photography or portraying to e.g. detailed explanation of making photos of candles).

For editing photos, software is needed. The course content should be independent on particular software vendors. Although programs like Adobe Photoshop are de facto standard, students should learn principles of photo editing instead of memorizing clicking on menus and buttons inside the window of the given program. The learning materials have to discuss utilization of several programs for different purposes (basic editing such as resizing, cropping and sharpening, advanced techniques such as portrait retouching or high dynamic range image processing, related operations with images such as publishing photos in online galleries etc.). Modeling knowledge of editing software is the next important part of the knowledge based on the course.

3 Ontologies and Topic Maps

It is evident that variability of knowledge types that should be covered by the course of Digital photography is enormous. It requires appropriate knowledge representation schemas. We decided to describe the structure of the course content by ontologies and then to
build Topic Maps application for presenting the resources of different types.

T. Gruber defined ontology as *formal, explicit specification of shared conceptualization of domain* [5]. Comments to this definition, given by [6] says:

- **conceptualization**: an abstract model of some phenomenon in the world produced by identifying the relevant concepts of the phenomenon,
- **explicit**: the type of concepts used and the constraints on their use are explicitly defined,
- **formal**: the ontology should be machine readable,
- **shared**: the ontology captures consensual knowledge, that is, it is not private to some individual, but accepted by a group.

Ontology establishes the vocabulary of the domain. It has to be developed by domain experts and the result represents the compromise of alternative viewpoints on the domain. In technical aspects, the shared opinion can be achieved, but in more subjective tasks (like evaluation of photos), the individual preferences and tastes come out. (Typically, less matured authors tend to place the main object in the center of the image while more experienced authors place the main object out of the centre – and both groups insist on their ideal compositions)

Some ontologies of photography were published, such as OWL ontology [3], and these can be reused for the purpose of our course.

Topic Maps technology addresses problems of information and knowledge representation and sharing, integration of knowledge resources, semantic web etc. [9]. An international Topic Maps standard (ISO/IEC 13250) was first published in 2000. Since it has been applied in numerous domains, see e.g. the list of applications of particular Topic Mapping software [2] and the list of Topic Mapping software vendors [12]. Annual series of international conferences on Topic Maps is held [10].

### 4 Conclusion

Photography is a great phenomenon. It is a mean of communication, it is a technology, it is a kind of art, sometimes it is said to be a state of mind. Ideally, our course of Digital Photography should show students how variable and nice the photography is and possibly it could change a bit their thinking about photos. At least, it should provide learning materials tailored to needs and expectations of individuals – to achieve this, we prepare the knowledge model of the domain of photography and we reuse it for building the web-based repository of learning resources. Our repository supports browsing and searching textual and image resources with respect to different criteria. The organization of the knowledge base supports variable types of knowledge, i.e. networks of concepts and relations, set of rules, recommendations, guidelines etc.

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### References: