Digital Analysis of Scenic Views and Panoramas

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Landscape is perceived by the observer from the eye-level, thus these types of views represent his sensations in the best way.

In the contribution quantitative and qualitative analyses of scenic views are presented, which can be conducted using digital techniques. The indicators are worked out that enable changes monitoring in time or support the expert in the process of decision making, regarding the acceptable extent of landscape transformations.

As a result of perspective distortion objects appear in the panorama in different scales; therefore image segmentation, aimed at the distinction of distance-dependent zones are implemented.

Introduction

The process of landscape perception is very complex and comprises several mental states, amongst the others: the purpose, the environmental context, observer's suppositions, his attitude, movement, visibility, view analysis, understanding, evaluation and remembering [1]. Most of them are too ephemeral to be modelled numerically.

Views form the key places (vantage points) can substitute the visual aspects of human sensations, because in this way people see and use landscape [2]. Images registered from this horizon can be divided into: narrow views (vistas), wide views and panoramas. He last ones embrace the angles larger than 90°. Because of physical aspects of sight, they cannot be noticed in detail at one glance.

Aims and methods in views and panoramas analyses

In the first step of the method positive and negative characteristics of the terrain are analysed. There are three approaches to landscape assessment: psychological, behavioural and expert ones [3]. In our case the last attitude ("the qualified judges method") was chosen. Basing on this evaluation, the set of aspects increasing and diminishing landscape values have been taken into consideration. Some of them (but not the all ones) can be parameterized, on the condition that their visual equivalent can be found.

Note 1. Ervin S., Steinitz C., Landscape visibility computation: necessary, but not sufficient, Environment and Planning B: Planning and Design 2003, volume 30

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Falconer, K., *Fractal Geometry: Mathematical Foundations and Application,* John Wiley & Sons, Chichester 2003

Gonzales R. C., Woods R. E., *Digital Image Processing,* Prentice Hall, New Jersey 2002

Smardon R. C., Palmer J. F., Felleman J. P., *Foundations for Visual Project Analysis*, New York 1986

Steinitz C., *Toward a Sustainable Landscape with High Visual Preference and High Ecological Integrity: the Loop Road in Acadia National Park, U.S.A.*, Landscape and Urban Planning, 19/1990 Elsevier, Amsterdam

Every view may be examined, as far as quantitative and qualitative parameters are concerned. Numerical values enable monitoring and controlling visual changes of the scenery in time, as well as supporting decision making on the acceptable landscape alterations. The first phase of analysis consists in distinguishing of landscape components (e.g. hills, forests, buildings). Bi-level images depicting categories of objects may be utilized as the binary masks [4]. Several geometrical aspects of edifices can be calculates, like the average size of the object, its shape factors or the mean image brightness, that is the evidence of the proportional share of the particular elements in the whole view.

With regard to the landscape structure analysis, diverse parameters have been examined as potential tools indicating its character and spatial dynamics. The value of the fractal dimension is related to the objects granularity, therefore it can point out components that are disharmonic in the environment, as far as their form or scale are taken into account [5]. Different scenarios of development can be modelled and evaluated.

Image segmentation

In scenic views and panoramas analyses many problems occur that are absent or can be eliminated in the other types of images. The most difficult of them concern variations in the colour of vegetation with seasonal changes (particularly in the autumn) and diverse lighting conditions (due to solar filtering, intensity, direction and orientation, in relation to the camera). The other aspect that should be included applies to geometrical distortion that results from the nature of the perspective projection. Edifices that are located in different distance-dependent zones cannot be compared, with respect to their geometrical parameters.

Manual image segmentation is very laborious and its effects can be biased, due to the tools used and the human factor, thus several techniques of image pre-processing have been introduce in order to automatize or semi-automatize this process. The effectiveness of vegetation indices utilized in the remote sensing for the greenery distinction in the eye-level views was examined. Because of unsatisfying results, the other ideas have been developed, like the concept of "the distance-dependent colour space" (using factors that depend on the remoteness – the atmospheric haze, contrast, colour diversity and saturation – as the new colour channels) or false colour compositions (making use of the visible spectrum – RGB channels - and the near infrared range).

In the resultant images the process of pixels classification into groups that depicts the real objects is facilitated. It may be conducted as the "supervised" technique, in which Bayesian naïve classifier is implemented.

Note 2. Steinitz C., *Toward a Sustainable Landscape with High Visual Preference and High Ecological Integrity: the Loop Road in Acadia National Park, U.S.A.*, Landscape and Urban Planning, 19 (1990 Elsevier, Amsterdam

Note 3. Smardon R. C., Palmer J. F., Felleman J. P., *Foundations for Visual Project Analysis*, New York 1986

Note 4. Gonzales R. C., Woods R. E., *Digital Image Processing,* Prentice Hall, New Jersey 2002

Note 5. Falconer, K., *Fractal Geometry: Mathematical Foundations and Application,* John Wiley & Sons, Chichester 2003

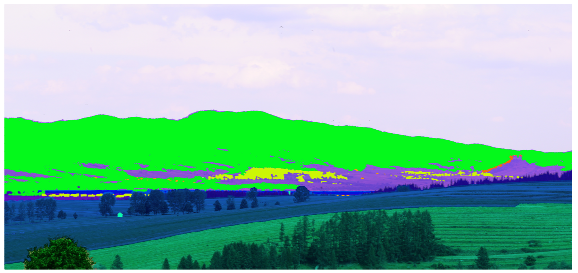

Fig. 1. Landscape values evaluation basing on the "qualified judges method"

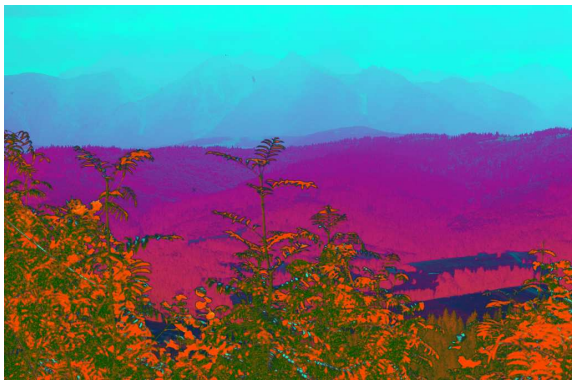

Fig. 2. The distance – dependent colour space