

## Evolution Potential – Basic Informative Attribute of the Information Carriers

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The informative attribute is a notion, describing a characteristic property or quality of an object, which contains a definite amount of object information. The larger it is, the higher its importance is and its contribution to the recognition of an object belonging to one or another class.

One object can be described by a different number of informative attributes. Theoretically the number of the informative attributes within the set of object characteristics is quite large. The use of sets with a great number of attributes is non-efficient. Hence, some subsets are formed with a limited number of informative attributes that describe completely the object and enable the recognition of the class it belongs to. Some appropriate methods are developed for this purpose.

Each product may be improved in the aspect of achieving the theoretic values of its parameters. Nevertheless there is not any criterion described in the references, which accounts the potential possibilities of the respective informative attributes describing one product.

The investigations concerning the formation of sets and subsets of informative attributes for magnetic disc information carriers [7, 8] and storing devices on magnetic discs (SDMD), [9] have implied the introducing of a new criterion for the informative attributes of hardware products, called evolution potential by the authors. This criterion in fact allows the estimation of the potential possibilities which one product possesses for improvement and/or development of new products from the corresponding class.

The significance and the application of the criterion suggested for evaluation of the informative attributes of the information carriers will be illustrated with the help of magnetic discs information carriers.

The information carriers in the narrow aspect of the word are media, on which information can be recorded, stored and read from. They have historical development. It can be conditionally accepted that the walls of the caves where human beings have lived are the first information carriers. The primitive people were clever enough to find out that the shadows of animals and people are more clearly distin-

guished on smooth walls. Thus probably the first pictures on the first carrier – the rocky wall have appeared. Its three attributes – plainness, smoothness and possibility to draw and store any information, describes this carrier. The form in this case depends on the cave walls.

We shall pass over the long period of development of the information carrier up to the papyrus. It has got the three basic attributes of the cave wall: plainness, smoothness and information storing which are present in each new kind of information carrier – paper, photosensitive plates and films.

We shall discuss the magnetic information carriers. The type of recording is changed. The medium has magnetic properties. The first magnetic carrier is a long metallic transducer with magnetic properties. The information element plainness is left for some time. Its absence hampers the process and it becomes again dominating in the magnetic tape. Moreover – the requirements towards the form and the informative attribute – smoothness are already exclusively high. But the information access is successive and slow. Nevertheless the evolution potential of the informative attributes – magnetic medium, magnetic recording, plainness and smoothness solve the problem for quick and direct access to the necessary information just altering the carrier form from tape to disc. The optical discs preserve the form, the plainness and smoothness; only the recording medium and type of recording are changed, which solves the problem for large carrier capacity.

The conservation of the main attributes plainness, smoothness, form, recording and information storing is obvious. The more concrete the example is, the more clearly the effect of the evolution potential is expressed. An example for this are the magnetic disc carriers. The evolution potential is contained in the theoretic capacities of the magnetic coating described by the following informative attributes:

- theoretical linear density of 500 000 bits per inch;
- radial density of 170 000 tracks per inch;
- surface density of 85 Gbits per square inch.

The informative attributes plainness, smoothness and round form have also evolution potential. They are preserved in all the generations of magnetic disc carriers with increased requirements.

The first generation of magnetic disc packs is IBM 1311 with linear density of 1020 bits per inch and radial density of 50 tracks per inch. The radial density is increased twice in the next generation IBM 2311 – 100 tracks per inch. In IBM 2314 generation just the linear density is amplified up to 2200 bits per inch, and then the radial – up to 200 tracks per inch. In IBM 3330-I the linear density is increased again twice and in IBM 3330-II – the radial – twice. The simultaneous increase of the two densities is done for the first time in modules IBM 3350 Winchester type with densities – 6425 bits per inch linear and 484 tracks per inch radial density, respectively.

- IBM 3370 – 12 000 bits per inch linear density, 685 tracks per inch radial density;
- IBM 3380 – 150 000 bits per inch linear density, 800 tracks per inch radial density;
- IBM 3390 – 28 000 bits per inch linear density, 2235 tracks per inch radial density;
- IBM laboratory model – 157 480 bits per inch linear density, 7276 tracks per inch radial density.

It is obvious that the problem with the great capacity is solved. The disc diameter is diminished to 8 inches, 5.25 inches, 3.5 inches, 2.5 inches, 1.8 inches and 1.3 inches. The effect of the evolution potential can be traced again in the geometric dimensions of the round form.

Having in mind the considerations and the digital data above given, the infor-

mative attribute, which will improve the magnetic disc packs must be selected. In this case these are the linear and radial recording density.

## References

1. Jain, A., D. Zongker. On attribute analysis and machine intelligence. – In: IEEE Trans. , **19**, 1997, No 2, 153-158.
2. Ferrll, F. P. Pudil, M. Hatef, J. Kittler. Attribute Recognition in Practice IV (Eds. E. Gelsema, L. Kanai). Elsevier Science B.V., 1994, 403-413.
3. Nousha, J. – In: Proceedings of ICPR, 1996, 186-190.
4. Hristov, H., G. Gluhchev, R. Hinova. Citophometria. Sofia, Medical Culture, 1983. 142 p.
5. Kittler, J. Attribute Recognition and Signal Processing. Sitjhoff and Nordhof, Aphen aan don Rijn, The Netherlands, 1978, 41-60.
6. Pudil, P., J. Novicova, J. Kittler. Attribute Recognitions Letters–15, November, 1994, 1119-1125.
7. Tzarnorechki, O., O. Daskalov. Informative attributes for adequate evaluation of storage technologies. – Compt. Rend. de l'Acad. Bulg. des Sciences, **46**, 1993, No 3, 49-51.
8. Tzarnorechki, O. An Approach to the Formation of Informative Attributes Subsets for Information Carriers– Compt. Rend. de l'Acad. Bulg. des Sciences, **53**, 2000, No 2 , 45-48.
9. Tzarnorechki, O., B. Vassilev. An approach defining the informative attributes of storing devices on magnetic discs at different hierarchical levels. – Working Papers – IIT/WP-85B, 1999.

## Эволюционный потенциал – основной информативный признак информационных носителей

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### (Р е з ю м е)

Рассматривается эволюционный потенциал информационных носителей и в частности, магнитных и оптических дисковых носителей в историческом аспекте. Так показывается приемственность трех основных качественных признаков – равнинности, гладкости и круглой формы. Приведены теоретические границы трех количественных признаков – линейной плотности записи, радиальной плотности и их производной – поверхностной плотности. На основе данных IBM прогнозируется, что определяющее в развитии производства будет увеличение линейной и радиальной плотности записи.