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Design of multimedia external representation: Cognitive processing

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Multimedia resources can be categorized into technology, representation and sensory areas. Technology refers to devices which display resources; representation, to formats of external representation; and sensory, to sensory modalities through which resource data are received. In terms of representation, effectiveness is measured as a function of developing user understanding, and requires the integration of new messages from multimedia resources and current understanding. This involves different cognitive processes including: Selecting, organizing and integrating. To successfully acquire new understanding, users need to select relevant multimedia messages presented in materials, then organize and integrate the selected messages. The design of external representations determines the level of engagement in different kinds of cognitive processing. We investigated design methods for multimedia external representations to maximize cognitive capacity and to more effectively engage cognitive processing. The data collected allowed us to define optimal design characteristics, which have useful practical implications for educational technology designers and educators, and can inform efforts to improve the design of digital multimedia materials. These characteristics may also assist multimedia designers to develop more intuitive and approachable interfaces that help users accept messages more effectively.

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Object-based VQ for image compression

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Vector quantization, VQ, is the process of picking suitable set of representative vectors, code book, to an extremely larger set. The use of representatives or their indices was widely applied in communication and multimedia compression. VQ techniques, for example k-means, adapt the code book vectors location in space to minimize representative's overall bin distortion. The VQ techniques treat boundary vectors contribution to distortion as any other point that leads to the possibility of forming clusters across the boundary of the classes or objects. The study highlights the possibility of having representatives that observe classes or objects boundaries. The code book generated is out of learning process to the classes or the connected regions. Consequently, the code book is not only effective in compression but also suitable for applications such as classifications and recognition. The proposed code book generation process is composed of three phases: Initialization, iterative, and finalization. In the initialization, the min-max algorithm is used to pick the initial code book. The min-max algorithm enables the choice of the code book size based on ceiling to the expected distortion. In the second phase, adapted LBG iterates on the code book, starting with the initial, to learn classes or objects boundaries. The iterative process focuses on using the miss-represented points to attract the right representative and repels the current. In the finalization phase, code book point that does not contribute to correct decoding is dropped from consideration in the final code book.

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