SVEUČILIŠTE U ZAGREBU
GRAFIČKI FAKULTET
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Postupak ocjene doktorskog rada

DOKTORAND/ICA:	Trpimir Jeronim Ježić, dipl. ing.

NASLOV RADA na hrv. jeziku:	Optimizacija vizualne komunikacije kvantizacijom njezinih stilova
NASLOV RADA na engl. jeziku:	Optimising visual communication by quantizing its styles

SAŽETAK:

Iako je pitanje organizacije nepregledne navale multimedijskih sadržaja već nekoliko desetljeća u središtu zanimanja razvoja informacijskih tehnologija, znatnije inovacije u razvoju tehnologija za semantički strukturiranu pohranu te dohvaćanje prirodno nastalih sadržaja izostaju. Disertacija se posvećuje ovom tehničkom pitanju informacijskih tehnologija. Analizirajući dosege primjenjivanih pristupa strojnomu tumačenju grafičkih poruka i razvoju sustava za preporuke sadržaja, te oslanjajući se na korpus znanja grafičkih eksperata i na brojne korektivne uvide suvremene statističke teorije, disertacija razrađuje novu metodologiju optimizacije vizualne komunikacije kroz konstrukciju razumljivog ujedinjenog distribucijskog prostora temeljnih informacijskih obilježja vizualnih kompozicija predstavljenih kroz kvantizaciju njihovih općih stilskih odrednica.

Ključne riječi: informacijske tehnologije; informacijsko doba; računalna estetika; konvolucijske živčane mreže; inženjerstvo obilježja; semantičko kodiranje; objašnjivo strojno učenje; grafičko inženjerstvo

EXTENDED ABSTRACT:

Despite the organization of the massive influx of multimedia content being the central question in development of informational technologies for last several decades, significant progress in the development of technologies for semantic-based storage and retrieval of naturally occurring content is still missing. The dissertation is focused on this technical issue of contemporary information technologies. By analyzing current approaches to machine interpretation of visual communications and to the development of content recommendation systems, and on the basis of accumulated knowledge of graphic engineers and numerous corrective insights of the modern theory of statistics, te dissertation will develop a new methodology for optimizing visual communication through the construction of an interpretable joint distribution space of basic informational features in visual compositions represented through quantification of their universal stylistic determinants.

The research field of computational aesthetics is a crucial contributor to the development of mechanisms for filtering and/or generating value-laden informational content. This paper acknowledges a recognized escalating problem in the development of contemporary informational technologies and presents a practical solution for communicational quality management by employing an innovative approach to the computational aesthetic evaluation (CAE). After discussing the problem and attempted approaches to its alleviation, dissertation offers a novel expert solution by presenting an original research approach and its resulting open-sourced model which outperforms its current state-of-the-art competition in semantic and stylistic classification, at the same time providing an idiomatic measure for objective aesthetic evaluation and demonstrating semantically rich and professionally recognized explanatory power which can serve as the solid basis for development of reliable and user friendly content retrieval, generative or auxiliary design applications. Presented model is resource- and privacy-wise upmost conservative. Its use evades all ethical, legal or security concerns that beset all currently prominent models. Its developmental and operational costs are practically nil.

In conclusion, this study presents a novel approach to semantic feature detection using convolutional neural networks fine-tuned on stylistically conditioned images of artworks from WikiArt. The models achieved high F1 scores and provided robust results in distinguishing between abstract-concrete (breadth) and iconic-symbolic (depth) dimensions of artistic expression. The findings suggest that the proposed method can be used for universal semantic feature detection, aiding in the interpretation of visual communications across different, past and future cultural periods. Additionally, the models provide an idiomatic aesthetic evaluation criterion, allowing for the assessment of artworks' success in visual communication based on their positioning within the semantic space. Further research could explore expanding the model's applicability to include more diverse and historically representative samples of artwork, as well as investigating the potential applications of this method in other domains such as graphic or multimedia design.

Keywords: informational technologies; information age; computational aesthetic evaluation; convolutional neural networks; feature engineering; semantic embeddings; interpretable machine learning; graphic engineering

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