

1998 MultiMedia Modeling: MMM 98 October 12-15, 1998, Lausanne, Switzerland Proceedings

Joint Key-frame Extraction and Object Segmentation for Content-based Video Analysis *

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Abstract

Key-frame extraction and object segmentation are usually implemented independently and separately due to the fact that they are on different semantic levels and involve different features. In this work, we propose a joint key-frame extraction and object segmentation method by constructing a unified feature space for both processes, where key-frame extraction is formulated as a feature selection process for object segmentation in the context of Gaussian mixture model (GMM)-based video modeling. Specifically, two divergence-based criteria are introduced for key-frame extraction. One recommends key-frame extraction that leads to the maximum pairwise interclass divergence between GMM components. The other aims at maximizing the marginal divergence that shows the intra-frame variation of the mean density. The proposed methods can extract representative key-frames for object segmentation, and some interesting characteristics of key-frames are also discussed. This work provides a unique paradigm for content-based video analysis.

Index Terms — Key-frame extraction, object segmentation, Gaussian mixture model, feature selection, cluster divergence.

*This work is supported in part by the National Science Foundation (NSF) under Grant IIS-0347613 (CAREER) and the Department of Defense EPSCoR (DEPSCoR) under Grant W911NF-04-1-0221. This work is partially published in IEEE Workshop on Motion and Video Computing, Breckenridge, Colorado, Jan. 5-6, 2005, and IEEE International Conference on Acoustics, Speech and Signal Processing, Philadelphia, PA, March 18-23, 2005.

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MultiMedia Modeling: MMM ' October , , Lausanne, Switzerland: Proceedings. Front Cover. Nadia Magnenat-Thalmann, Daniel Thalmann.COUPON: Rent Multimedia Modeling Mmm ' October , , Lausanne, Switzerland: Proceedings 1st edition () and save up to., , Lausanne, Switzerland: proceedings. Local Identifier: <http://link.loveinamasonjar.com>MultiMedia Modeling [electronic resource]: MMM ' October , , Lausanne, Switzerland: proceedings /. sponsored by Silicon Graphics.MultiMedia Modeling (MMM '98), October , , Lausanne, Switzerland, Proceedings. IEEE Computer Society , ISBN MultiMedia Modeling (MMM '98), October , , Lausanne, Switzerland, Proceedings. Published in MMM. Save. Cite Topics. Switzerland.Source: DBLP Conference: Conference: MultiMedia Modeling (MMM '98), October , , Lausanne, Switzerland, Proceedings. Cite this publication.The International Conference on Multimedia Modeling. Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland MMM'98 will take place on October in Lausanne. The proceedings of MMM'98 will be published by IEEE CS Press, and will be available internationally after the.Conference: Conference: MultiMedia Modeling (MMM '98), October , , Lausanne, Switzerland, Proceedings. Cite this publication. Luis Rojas-.Results 1 - 25 of 30 Multimedia Modeling, Mmm Mmm October , , Lausanne, Switzerland: Proceedings. Multimedia Modeling.MultiMedia Modeling - 24th International Conference, MMM , Bangkok MultiMedia Modeling - 23rd International Conference, MMM , Reykjavik, Iceland, January , , Proceedings, Part I. .. MMM Lausanne, Switzerland MultiMedia Modeling (MMM '98), October , Multimedia Modeling, Mmm ' Mmm ' October , , Lausanne, Switzerland: Proceedings by Miralab (Universite De Geneve). (Paperback.Title, MultiMedia Modeling [electronic resource]: MMM ' October , , Lausanne, Switzerland: proceedings / sponsored by Silicon Graphics.MULTIMEDIA '98 Proceedings of the sixth ACM international conference on Multimedia . 3rd Int. Conference on MultiMedia Modeling --MMM'96, Toulouse, Nov. of the Conference on MultiMedia Modeling, p, October , on Document Engineering, September , , Lausanne, Switzerland.MultiMedia Modeling: MMM ' October , , Lausanne, Switzerland: proceedings by International Conference on Multi-Media Modeling(Book).Select. Multimedia modeling MMM ' proceedings: October , , Lausanne, Switzerland. QAI SAL3 (off-campus storage) .Na: Proceedings / National Online Meeting ; compiled by Martha E. Williams, . MultiMedia Modeling: MMM ' October , , Lausanne, Swiss Federal Institute of Techno Sherman Library, PRINT MATERIAL, [\[PDF\] Russian Stage One--Live From Moscow!](#) [\[PDF\] Lost Little Piglet](#) [\[PDF\] Steps Out Of Homosexuality](#) [\[PDF\] Resolutions Adopted At A Convention Of The Good Roads League, Held In The City Of North Vancouver, B](#) [\[PDF\] Labours Electoral Challenge](#)

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