

# A Framework For TV Logos Learning Using Linear Inverse Diffusion Filters For Noise Removal

Julián R. Cózar<sup>1</sup>, Vesna Zeljković<sup>2</sup>, José M<sup>a</sup> González-Linares<sup>1</sup>, Nicolás Guil<sup>1</sup>, Claude Tameze<sup>3</sup>, Ventzeslav Valev<sup>4</sup>

<sup>1</sup> Computer Architecture Department, University of Málaga, Málaga, Spain

<sup>2</sup> School of Engineering & Computing Sciences, New York Institute of Technology, Nanjing Campus, USA,  
[vzeljkov@nyit.edu](mailto:vzeljkov@nyit.edu)

<sup>3</sup> Department of Mathematics & Computer Science, Lincoln University, PA, USA

<sup>4</sup> Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, Sofia, Bulgaria

**Abstract**— Different logotypes represent significant cues for video annotations. A combination of temporal and spatial segmentation methods can be used for logo extraction from various video contents. To achieve this segmentation, pixels with low variation of intensity over time are detected. Static backgrounds can become spurious parts of these logos. This paper offers a new way to use several segmentations of logos to learn new logo models from which noise has been removed. First, we group segmented logos of similar appearances into different clusters. Then, a model is learned for each cluster that has a minimum number of members. This is done by applying a linear inverse diffusion filter to all logos in each cluster. Our experiments demonstrate that this filter removes most of the noise that was added to the logo during segmentation and it successfully copes with misclassified logos that have been wrongly added to a cluster.

**Keywords**— *logotype; video segmentation; linear inverse diffusion filter; clustering*

## REFERENCES

- [1] J.R. Cózar, N. Guil, J.M. González-Linares, E.L. Zapata, and E. Izquierdo, "Logotype detection to support semantic-based video annotation", *Signal Processing: Image Communication*, vol. 22, pp. 669–679, 2007.
- [2] A. Ekin, "Robust, Hardware-Oriented Overlaid Graphics Detection for TV Applications", in "TV Content Analysis: Techniques and Applications", Y. Kompatsiaris, B. Meriardo, S. Lian, Eds. CRC Press, pp. 95-120, 2012.
- [3] J.R. Cózar; N. Guil; J.M. González-Linares; E.L. Zapata, "Video Cataloging Based On Robust Logotype Detection", *IEEE International Conference on Image Processing (ICIP)*, pp. 3217 – 3220, 2006.
- [4] J. R. Cózar, P. Nieto, J. M. González-Linares, Y. Hernández-Heredia, N. Guil, "Detection of logos in low quality videos", *11<sup>th</sup> International Conference on Intelligent Systems Design and Applications, ISDA11*, Cordoba, Spain, pp. 630 – 635, 2011.
- [5] P. Nieto; J.R. Cózar; J.M. González-Linares; N. Guil, "A TV-Logo Classification and Learning System", *IEEE Int'l Conf. On Image Processing (ICIP)*, pp. 2548 - 2551, 2008.
- [6] I. Pollak, A.S. Willsky, and H. Krim, "Scale space analysis by stabilized inverse diffusion equations", *Proceedings of the First International Conference on Scale-Space Theory in Computer Vision*, pp. 200 – 211, 1997.
- [7] I. Pollak, A.S. Willsky, and H. Krim, "Image segmentation and edge enhancement with stabilized inverse diffusion equations", *IEEE Transactions on Image Processing* 9 (2), pp. 256-266, 2000.
- [8] R. Vincelette, C. Tameze, V. Zeljković, E. Izquierdo, "Noise removal from polygonal shapes using combined inverse diffusion filter and triangle method", *IEEE conference CBMI 2008*.
- [9] V. Zeljković, C. Tameze, R. Vincelette, E. Izquierdo, "Nonlinear Diffusion Filter and Triangle Method Used for Noise Removal from Polygonal Shapes", *VIE 2008*, IEEE conference.
- [10] V. Zeljković, R. Vincelette, C. Tameze, "Combined Nonlinear Inverse Diffusion Filter and Triangle Method Used for Noise Removal from Polygonal Shapes", *ICIP 2008*, IEEE conference.
- [11] V. Zeljković, C. Tameze, R. Vincelette, E. Izquierdo, "Different Nonlinear Diffusion Filters Combined with Triangle Method Used for Noise Removal from Polygonal Shapes", *IET Image Processing*, 2009.