Morphology-Based Hierarchical Representation with Application to Text Segmentation in Natural Images

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At a Glance

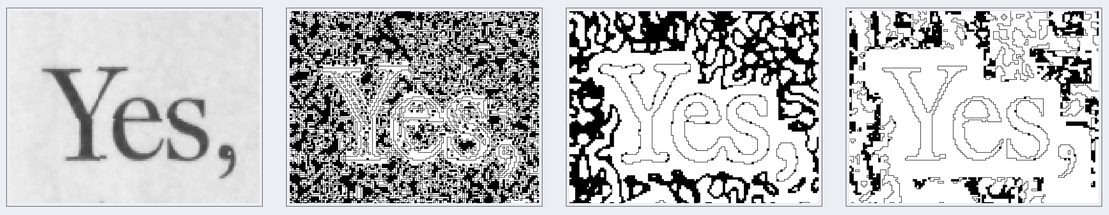
Problem statement:
- Many **text segmentation** methods are too elaborate for real-time implementation.
- Need of robustness to noise, blur, or uneven illumination.

Why our approach is interesting:
- Simple morphological Laplacian but state-of-the-art results. • Linear time complexity.

Conclusion: our solution achieves
- A new hierarchical representation of images.
- A good trade-off between efficiency and quality.
- A robust method w.r.t contrast changes.
- A solution taking advantage of mathematical morphology.

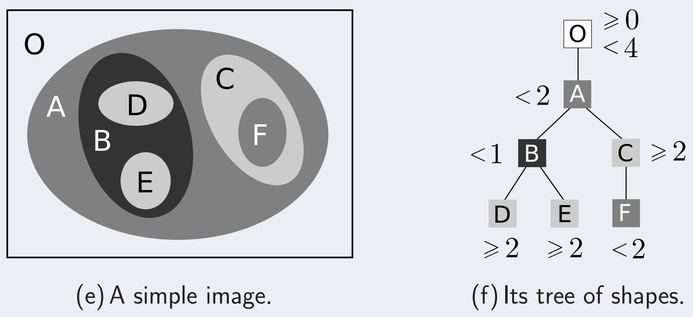
Background

Morphological Laplacian operator: $\Delta_{\mathcal{N}} = (\delta_{\mathcal{N}} - \mathrm{id}) - (\mathrm{id} - \varepsilon_{\mathcal{N}})$



(a) Input u. (b) $\Delta_4(u) = 0$. (c) $\mathrm{LoG}_{17}(u) = 0$. (d) $\Delta_{\square_{17}}(u) = 0$.

Tree of Shapes: a representation of the image contents by inclusion [1]

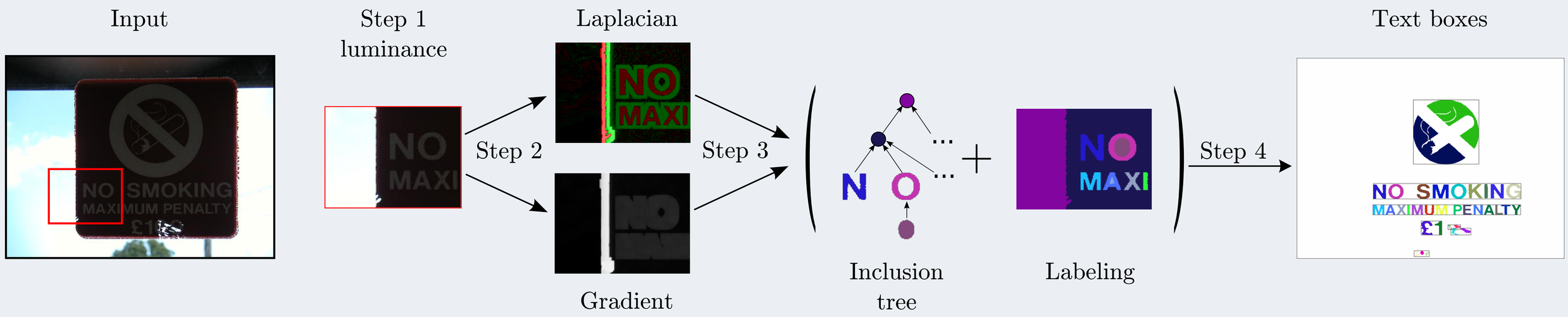


(e) A simple image. (f) Its tree of shapes.

Some results

Results using "ICDAR 2015 Robust Reading Competition" Challenge 2 DB.

Proposed solution



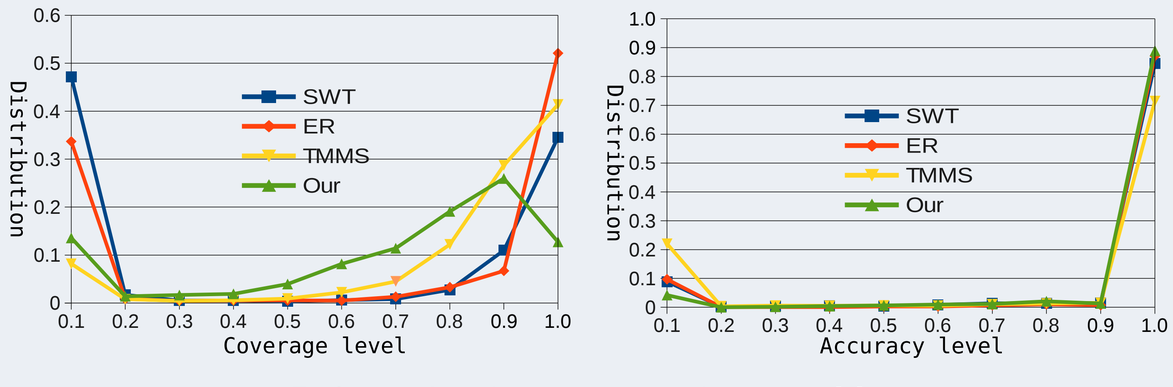
Proposed pipeline:

Step 1: Convert to gray level;
Step 2: Compute the morphological laplacian and gradient;
Step 3: Label regions delimited by the 0-crossings and obtain the tree of shapes;
Step 4: Group components together to form text boxes.

Quantitative results

Method	Recall	Precision	F-score	Consistency
SWT [3]	0.464192	0.8861	0.609232	0.505042
ER [4]	0.613059	0.892023	0.629221	0.726689
TMMS [5]	**0.784568**	0.7522	**0.768043**	0.791303
Propose method	0.636168	**0.933058**	**0.756528**	**0.849754**

Text segmentation comparison



Evaluation based on coverage and accuracy [2].

Selected Bibliography

[1] T. Géraud, E. Carlinet, S. Crozet, and L. Najman, "A quasi-linear algorithm to compute the tree of shapes of n-D images.," in *Proc of ISMM*. 2013, vol. 7883 of *LNCS*, pp. 98–110, Springer.

[2] S. Calarasanu, J. Fabrizio, and S. Dubuisson, "Using histogram representation and Earth Mover's Distance as an evaluation tool for text detection," in *Proc. of ICDAR*, 2015, pp. 221–225.

[3] B. Epshtein *et al.*, "Detecting text in natural scenes with stroke width transform," in *Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition (CVPR)*, 2010, pp. 2963–2970.

[4] L. Neumann and J. Matas, "Real-time lexicon-free scene text localization and recognition," *IEEE Trans. on PAMI*, vol. 38, no. 9, pp. 1872–1885, 2016.

[5] J. Fabrizio, M. Robert-Seidowsky, S. Dubuisson, S. Calarasanu, and R. Boissel, "TextCatcher: A method to detect curved and challenging text in natural scenes," *IJDAR*, pp. 1–19, 2016.