Illumination invariant Pre-transformations for Automotive Image Segmentation

1. The Goal

- Compare already existing illumination invariant image representations
- Establish the influence of adding chromatic components of color space

2. The CamVid dataset

701 labeled images of 32 semantic classes, of which only 11 are used in this problem.

- 960 x 720 RGB images, which are reduced to 480 x 360

Fig. 3: An example image from the CamVid dataset [18] along with its annotations.

3. The Network Architecture

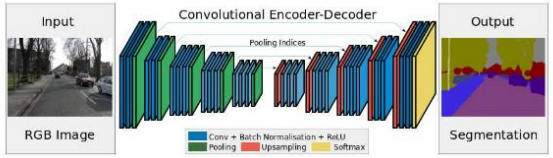

Fig. 4: Architecture of the SegNet Convolutional Neural Network [1].

4. Illumination Invariant Transforms

4 variations were compared in the paper, 2 are compared by us:

Maddern [2]

Alvarez [3]

5. Results:

THEIRS	Class avg.	Global acc.	mIoU	Precision	Recall
RGB	0.61	0.81	0.46	**0.70**	0.61
Maddern	0.54	0.78	0.40	0.64	0.65
MaddernHS	**0.68**	**0.87**	**0.56**	0.69	**0.68**
OURS					
RGB	**0.75**	**0.84**	**0.59**	**0.75**	**0.51**
Maddern					
MaddernHS	0.57	0.64	0.42	0.57	0.31

6. Discussion

There is a variety of possible reasons why we did not come to come to the same results are the authors of the paper. Many come from insufficient descriptions about the steps they took. Some arise from the lack of knowledge we have on the subject of color transforms.

1. Lack of explanation the author give about the 11 classes that are used and how they are created from the 32 CAMVID dataset [4].
2. It is unclear if Local contrast normalization is performed on the RGB images. Also, if this is performed there is no standard deviation given
3. The authors say they use the pre-trained SegNet. This is trained for images with 3 channels, not for images with only 1 channel.
4. 3 out of 4 transforms make use of the invariant direction/angle which is a device specific angle, that can be computed in different ways. It was unclear which methods the authors used.

References

[1] V. Badrinarayanan, A. Kendall, and R. Cipolla, "Segnet: A deep convolutional encoder-decoder architecture for image segmentation," IEEE Transactions on Pattern Analysis and Machine Intelligence

[2] W. Maddern, A. Stewart, C. McManus, B. Upcroft, W. Churchill, and P. Newman, "Illumination invariant imaging: Applications in robust vision-based localisation, mapping and classification for autonomous vehicles,"

[3] J. Alvarez and A. Lopez, "Road detection based on illuminant in- ´ variance," IEEE Trans. on Intelligent Transportation Systems

[4] G. Brostow, J. Fauqueur, and R. Cipolla, "Semantic object classes in video: A high-definition ground truth database," Pattern Recognition Letters, vol. 30, no. 2, pp. 88–97, 2009