Adaptive fusion algorithm for VIS and IR images driven by neural network

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Overview

1. Fusion of VIS and IR image
2. Fusion Quality Evaluation
3. Adaptive fusion
4. Conclusion

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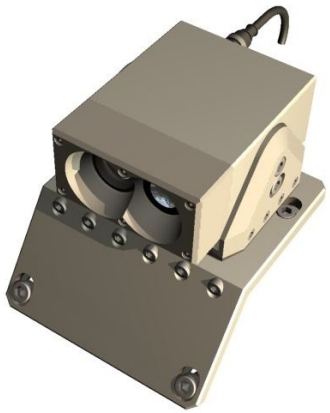
PRAMACOM Image Fusion Unit

- Self consisten device with VIS and LWIR cameras, computational unit a video interface.
- Czech army transport vehicles.



Multiresolution Image Fusion

Parameters of Multiresolution Fusion




Different Light Conditions

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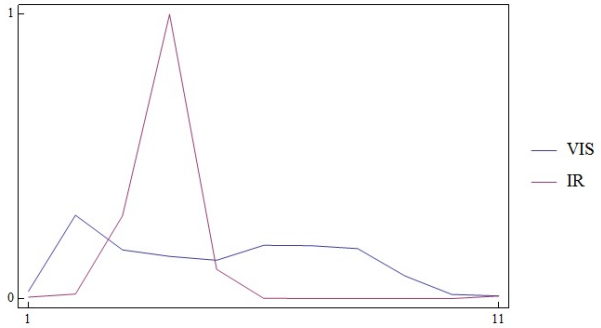

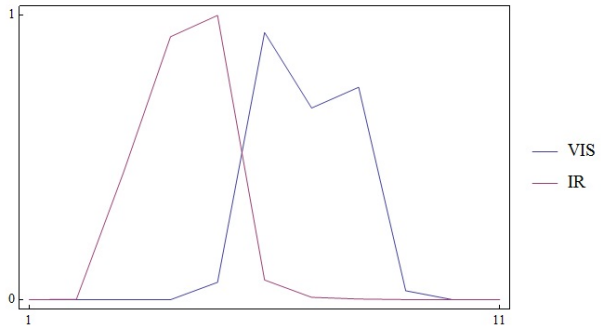

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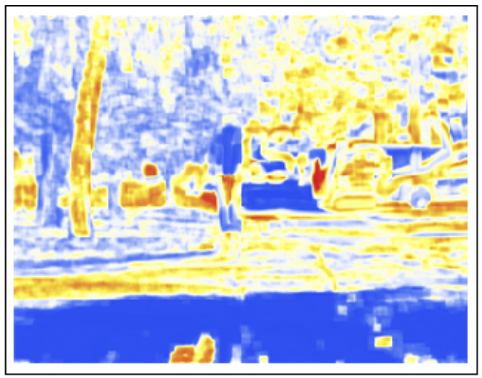
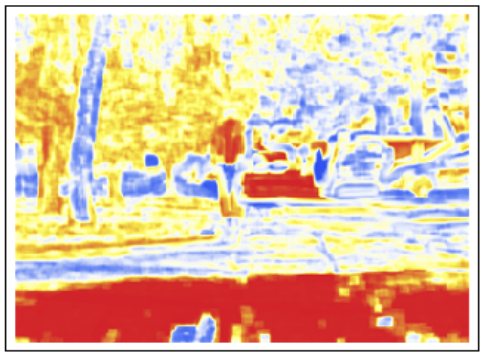
Piella-Heijmans Quality Metric

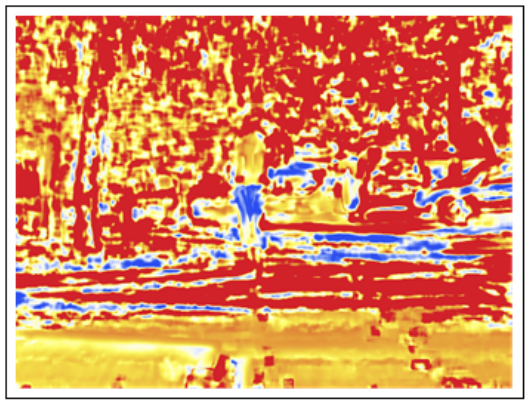
Theorem

$$Q(VIS, IR, F) = \frac{1}{|W|} \sum_{w \in W} \left(\lambda(w) SSIM(VIS, F \mid w) + (1 - \lambda(w)) SSIM(IR, F \mid w)\right),$$

$$SSIM(a, b \mid w) = \frac{4\sigma_{ab}\bar{a}\bar{b}}{(\bar{a}^2+\bar{b}^2)(\sigma_a^2+\sigma_b^2)}$$







Subjective Evaluation

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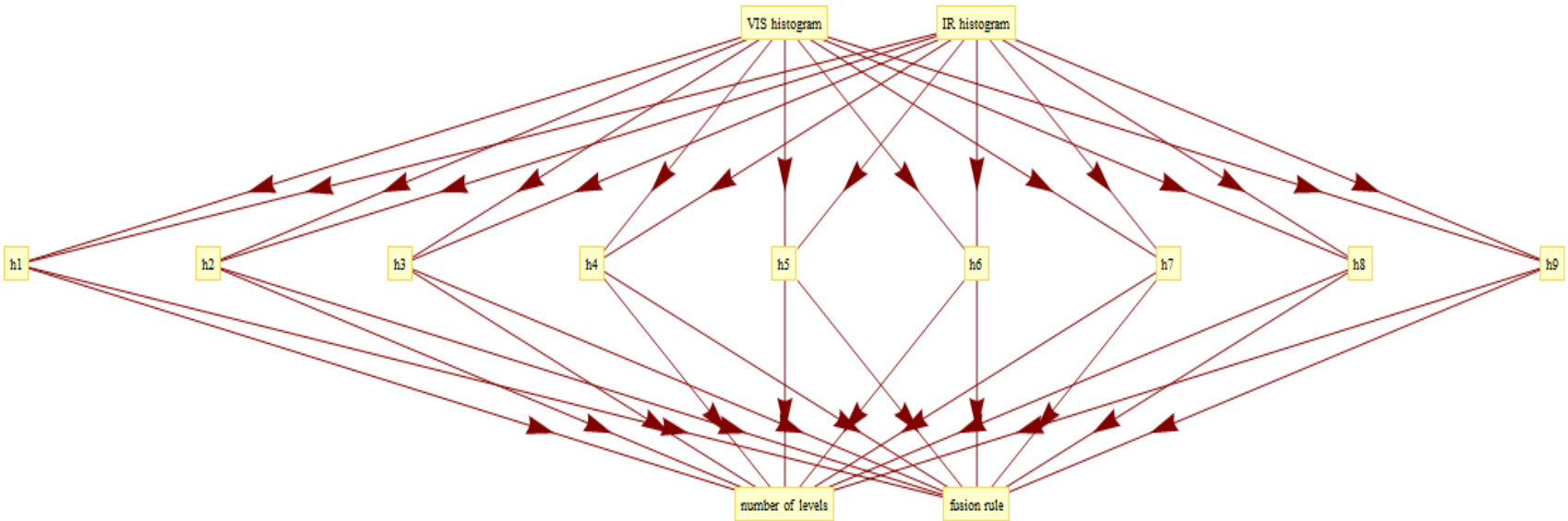
- Training dateset is constructed with the help of both objective and subjective evaluation of fusion process.

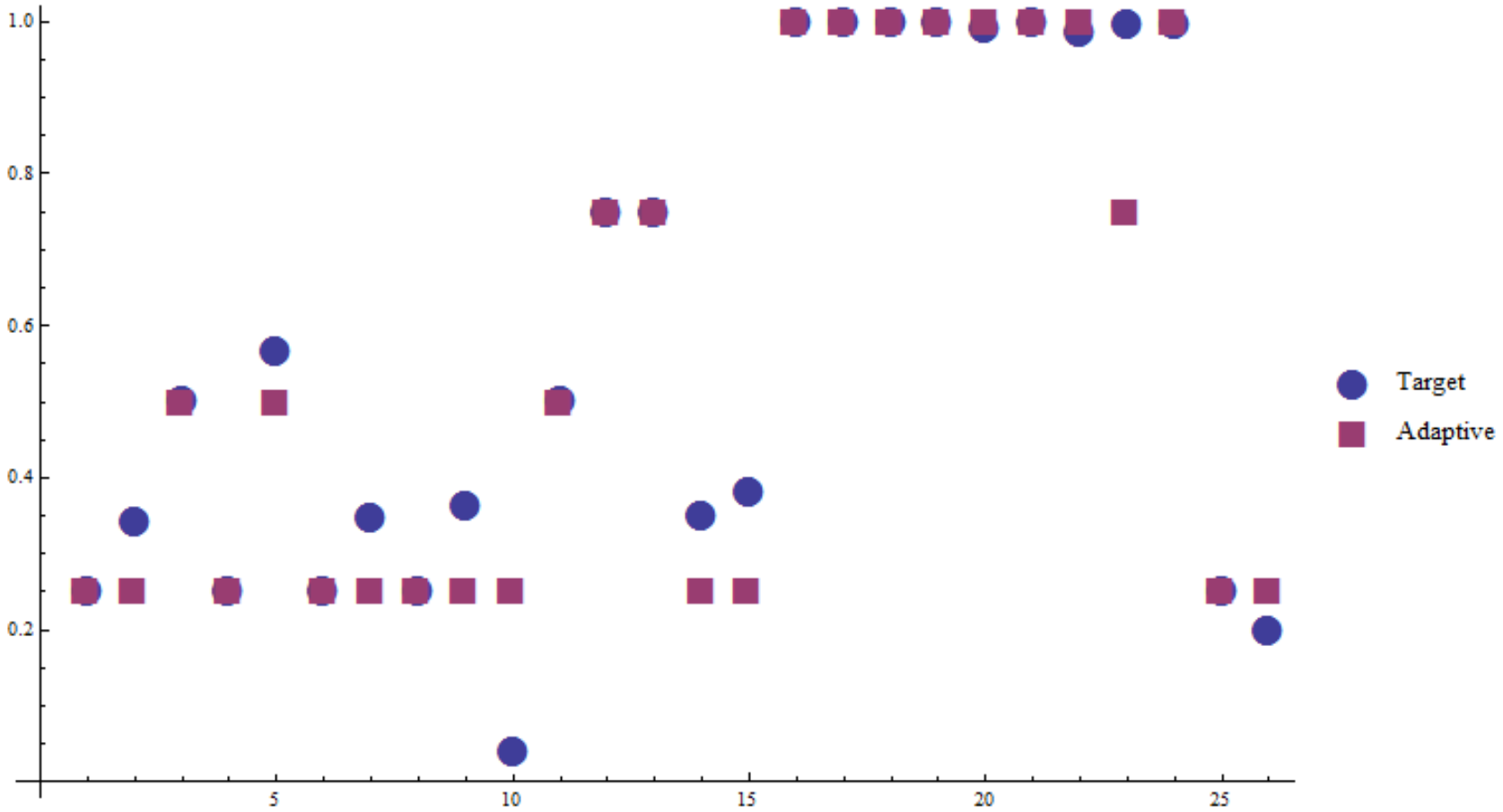
Neural network

- 22 values- VIS and IR 11 bin histograms
- 9 hidden nodes
- 2 output parameters of multiresolution algorithm



Adaptive System Output vs. Target Samples

- The adaptive system seting of fusion rule parameter is compared with target samples.



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- Multiresolution algorithm was implemented.
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- The classification neural network was used as a basic concept.
- Network was trained with the help of both objective and subjective evaluation of fusion process.

Acknowledgments

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