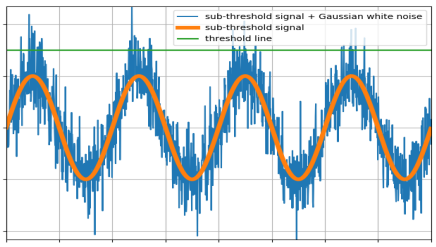
Study on Effect of Stochastic Resonance to the Accuracy of Convolutional Neural Network

研究の概要と特徴 Research Overview

Study how the phenomenon of Stochastic Resonance (SR) can effect the detection accuracy of the Deep Learning model.

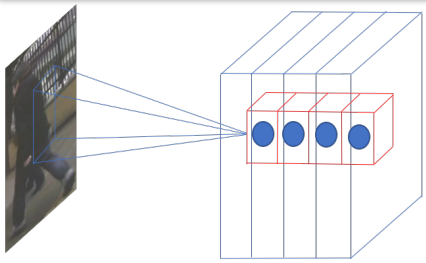
研究の内容 Research Contents

Stochastic Resonance (SR)



- In a nonlinear system, appropriate amount of noise could be beneficial and this phenomenon is called Stochastic Resonance (SR)
- SR has been said to occur in a lot of natural phenomenon
- Left figure depict the idea of SR

Convolutional Neural Network (CNN)



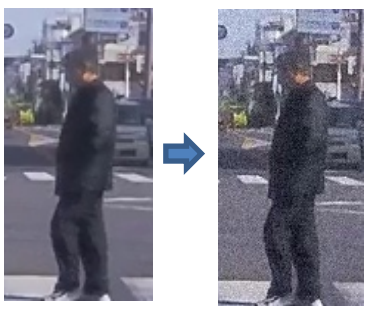
Kernels of the CNN (in this case, 4 layers of kernels)

- A type of Deep Neural Network (DNN)
- In this research, AlexNet will be used

Experiment

1. AlexNet is trained on thousands of images (vehicle + pedestrian)
2. The model is then evaluated with the normal images for baseline accuracy
3. The model is then evaluated with images + white Gaussian noise

Example



A pedestrian image applied with white Gaussian noise

Result

Normal Distribution	Accuracy [%]
No noise	98.84
N(0, 1)	98.80
N(0, 3)	98.80
N(0, 5)	98.88
N(0, 7)	98.88
N(0, 9)	98.80

・Some noise can decrease and some noise can increase the accuracy result
・However, the relations between noise and accuracy result is still not solid
・Different type of noise is expected to affect differently to different type of dataset and this is still yet to be investigated

結論 Conclusion

- Noise do can affect the accuracy of the Deep Learning model
- Still a lot of noises need to be tested thoroughly with other CNN models

技術応用分野・企業との連携要望 Technology application and cooperation with companies

Company that using and researching deep learning in object detection domain

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