

Interpretation of deep neural networks : Motivation for medical applications

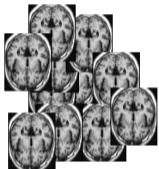
Introductory talk

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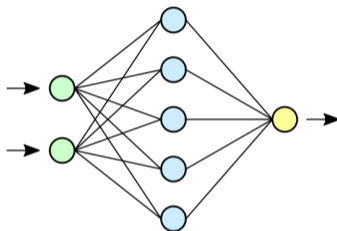
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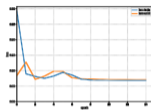
Medical Image Analysis/Processing with deep learning



Split Train/Valid/Test



*Choose adequate
architecture, loss function, ...*



*train on Train
+ monitor on Valid*

Report performance
on the Test dataset.

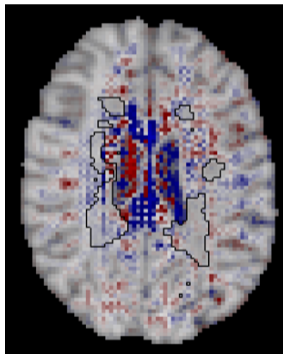
- ▶ Test set error
 - Dataset split : what if there is a bias in the original dataset ? 😞

- ▶ Classification between different dataset (e.g. diagnosis Healthy vs Pathology)
 - do you discriminate some Healthy vs Pathology features ?
 - do you discriminate some dataset signatures ? 😞

Understanding the decision ?

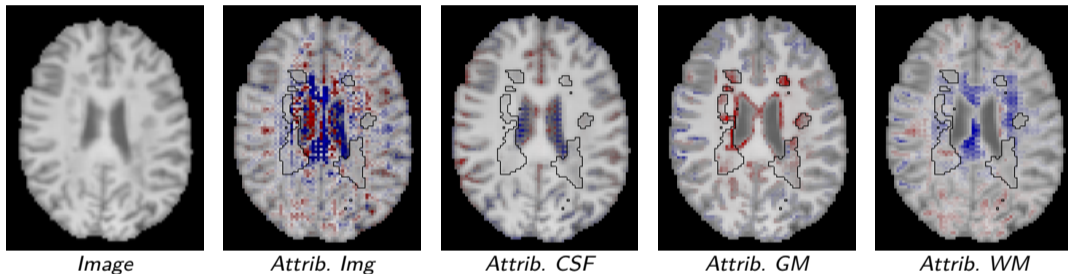
Attribution maps : which pixels contribute the most in the decision

- ▶ positive contribution (red)
- ▶ negative contribution (blue)



Attribution maps

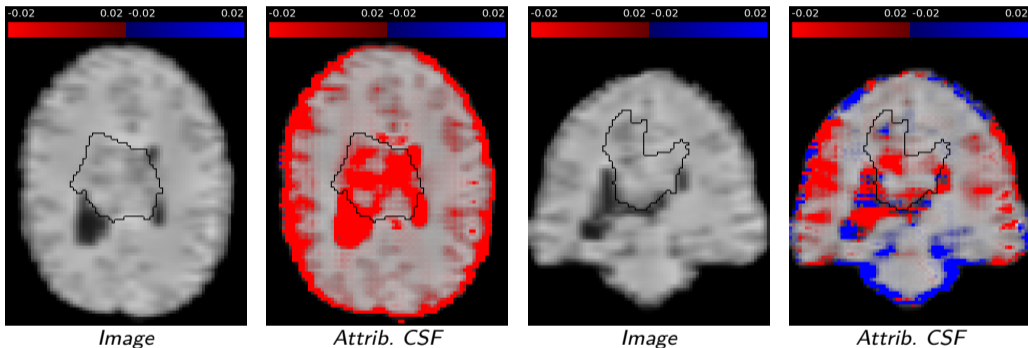
Example : Attribution maps for Healthy vs Multiple Sclerosis classification



Healthy vs MS subject classification using probability maps as network inputs :

- ▶ More interpretable attribution maps
- ▶ Accuracy : 85% → 95%

Example : brain tumors



Attribution of a brain tumor patient (Brats2020) vs healthy subject (IXI) deep classifier using probability maps as network inputs.

Next Presentation :

Debugging and Understanding Deep Learning Models

- ▶ Identify which pixels/voxels are important in the decision
- ▶ How to analyse hidden features
- ▶ Visualize what the network learn
- ▶ ...



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Acknowledgments - References - Credits

- ▶ France Life Imaging ANR-11-INBS-0006.
- ▶ LABEX PRIMES (ANR-11-LABX-0063, ANR-11-IDEX-0007)
- ▶ MS dataset : www.ofsep.org
- ▶ Healthy subject dataset : brain-development.org/ixi-dataset
- ▶ Brats tumor dataset : Menze etal TMI 2015, Bakas etal, Nature Scientific Data, 2017
- ▶ Wargnier etal ISBI 2021

Thanks for your attention !!