Nonlinear registration as an effective preprocessing technique for Deep learning based classification of disease

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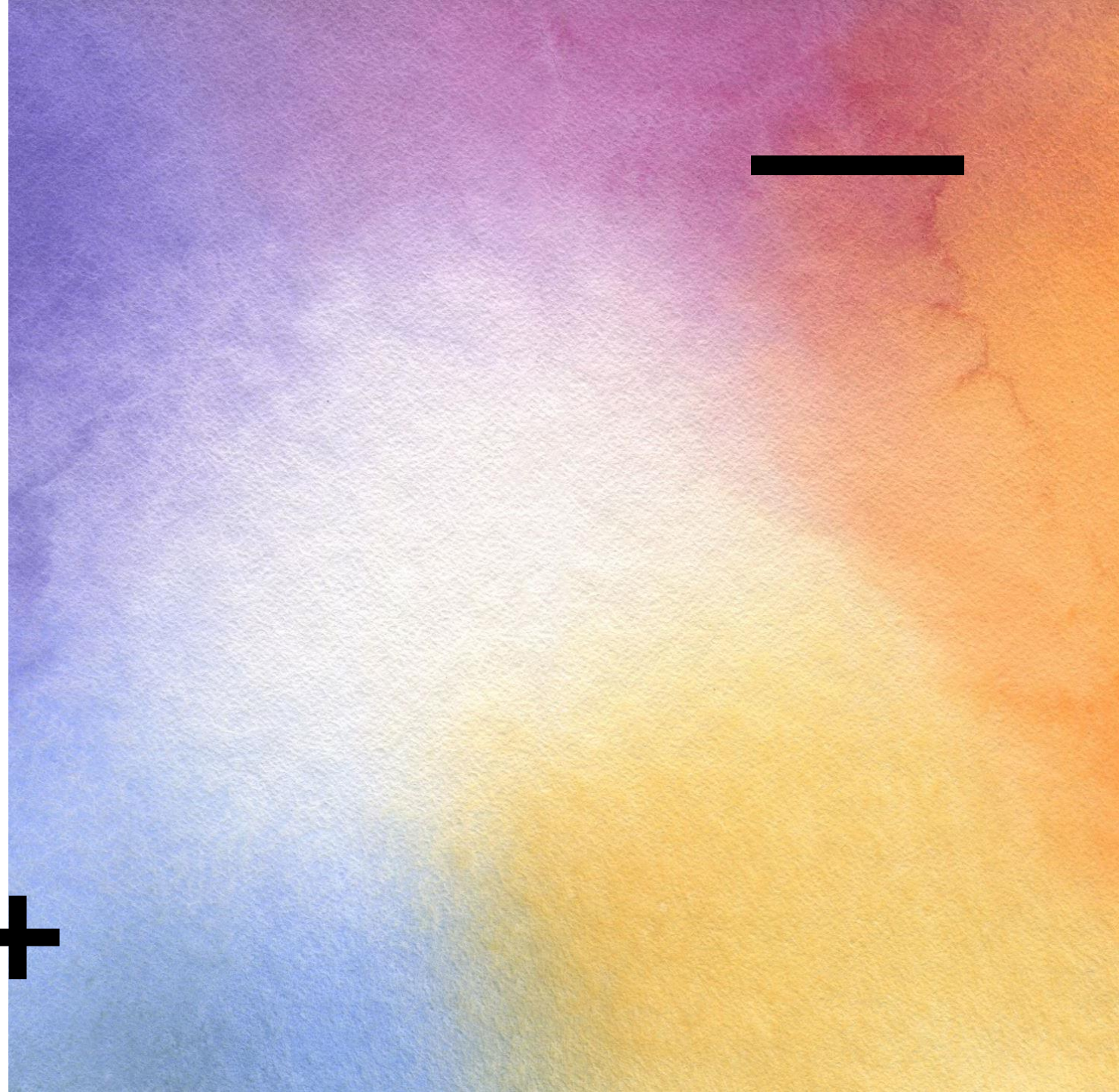
CMPE 258



Introduction

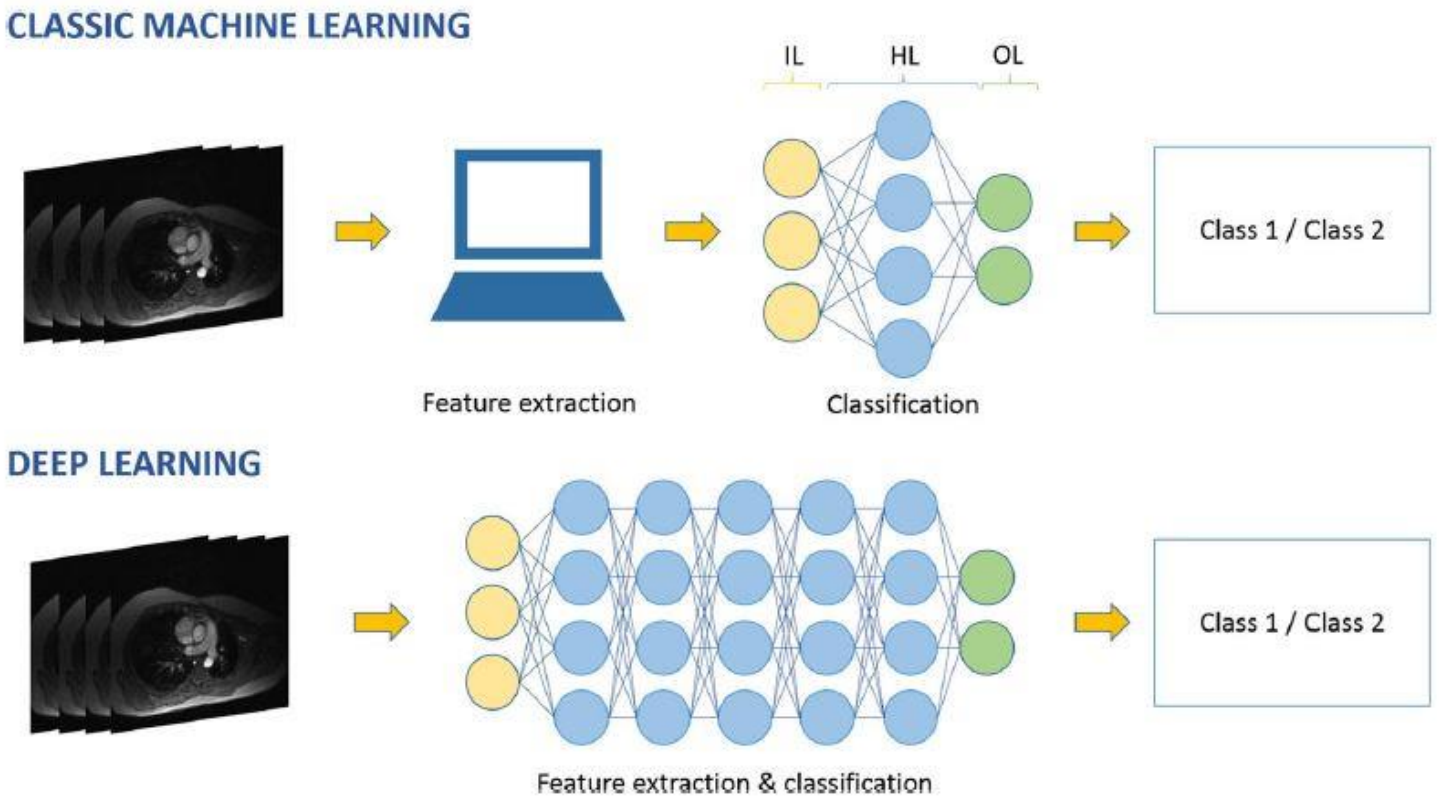
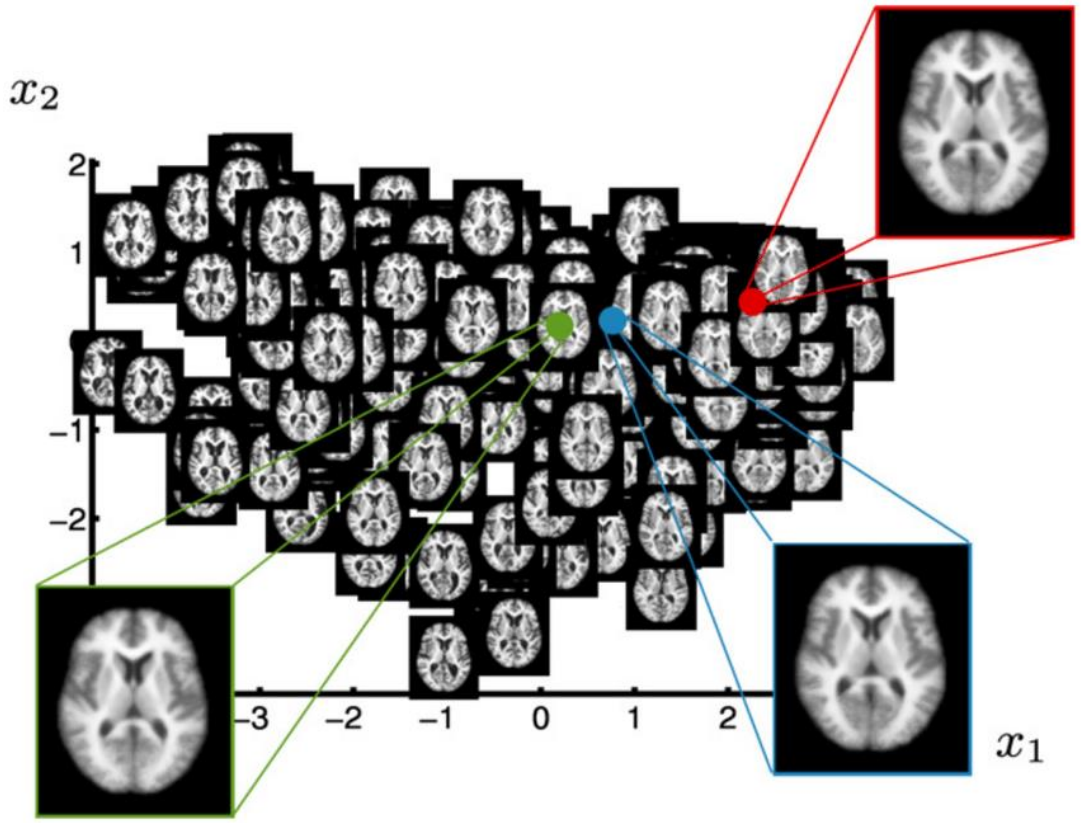


Image classification on Alzheimer ’s disease (AD)

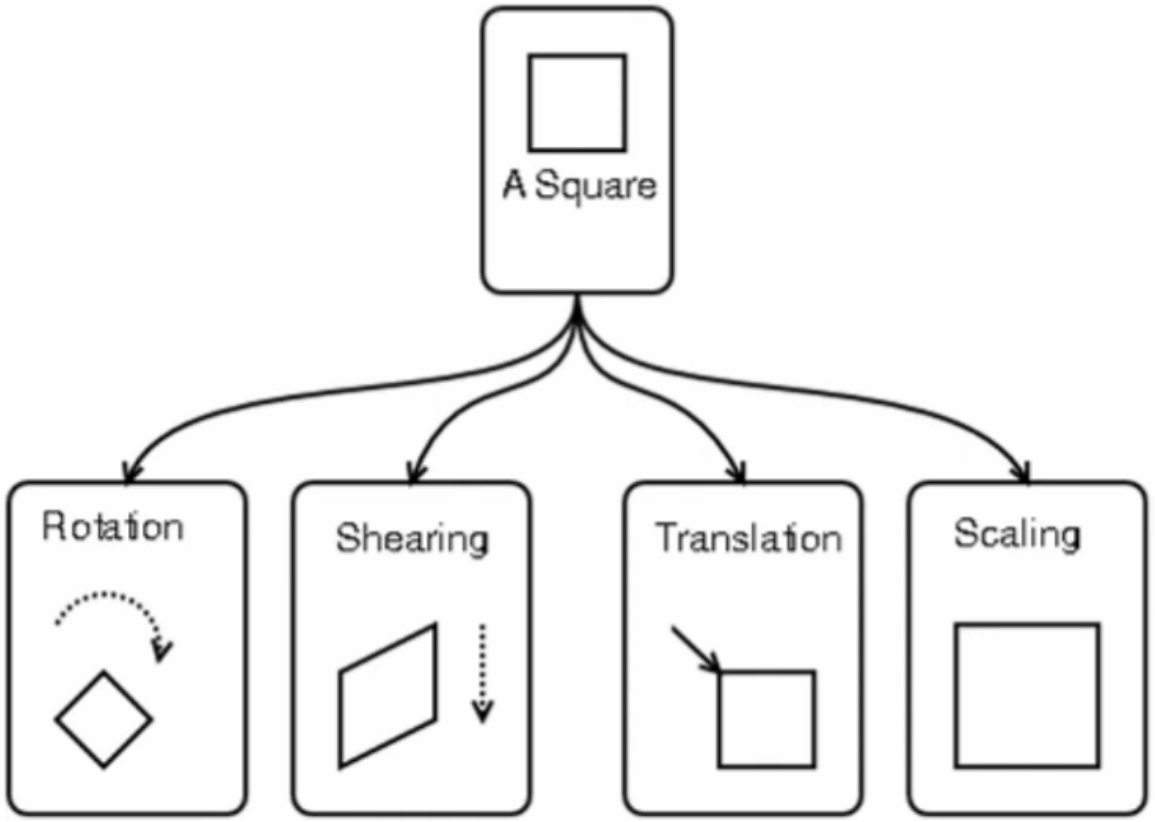


Methods for reducing Overfitting

- Affine registration
- DARTEL (Diffeomorphic Anatomical Registration Through Exponential Lie Algebra)

Affine registration

Affine transformation



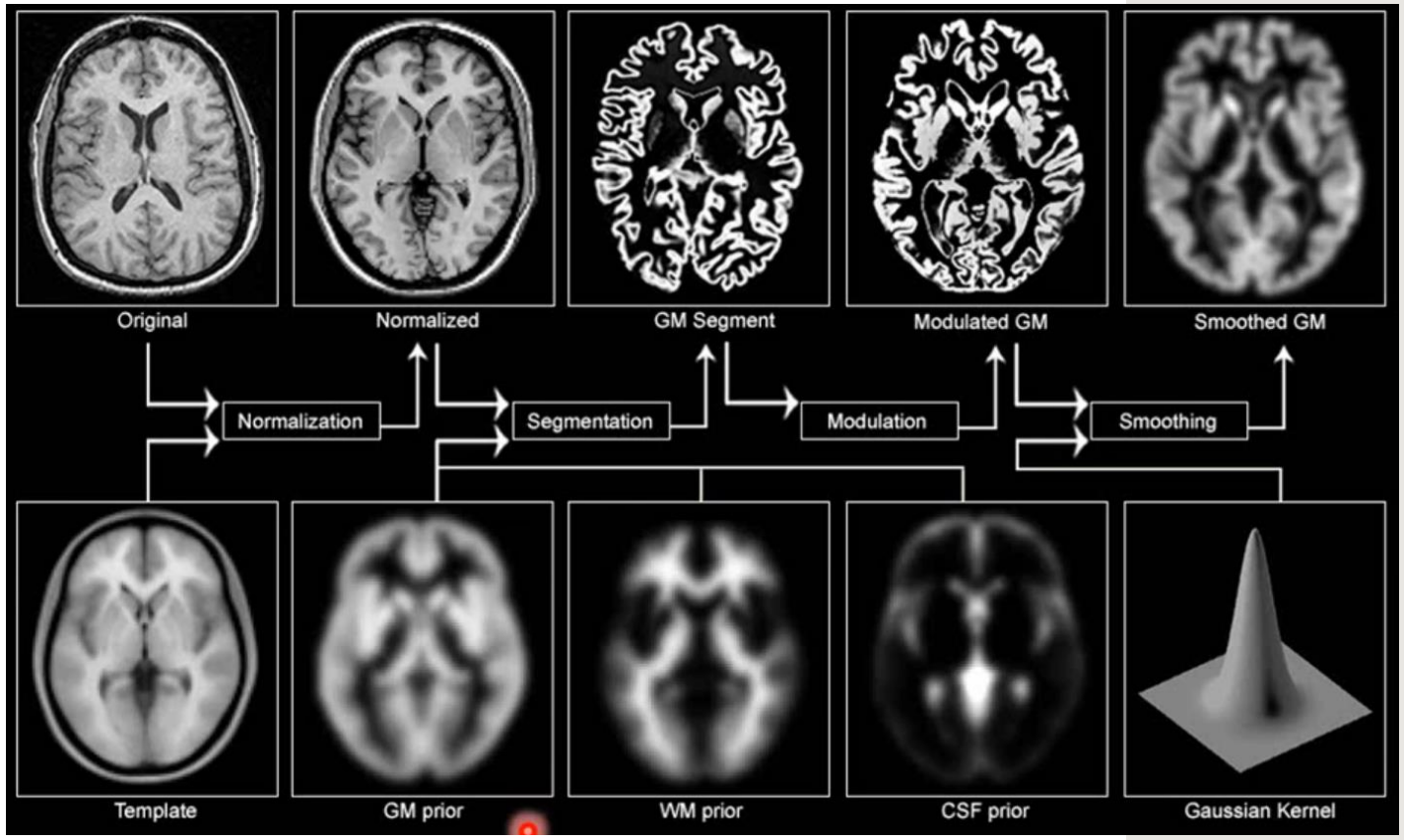
$$J(x,y) = I\big(T(x,y)\big) \Rightarrow I(x + t_x, y + t_y)$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$$

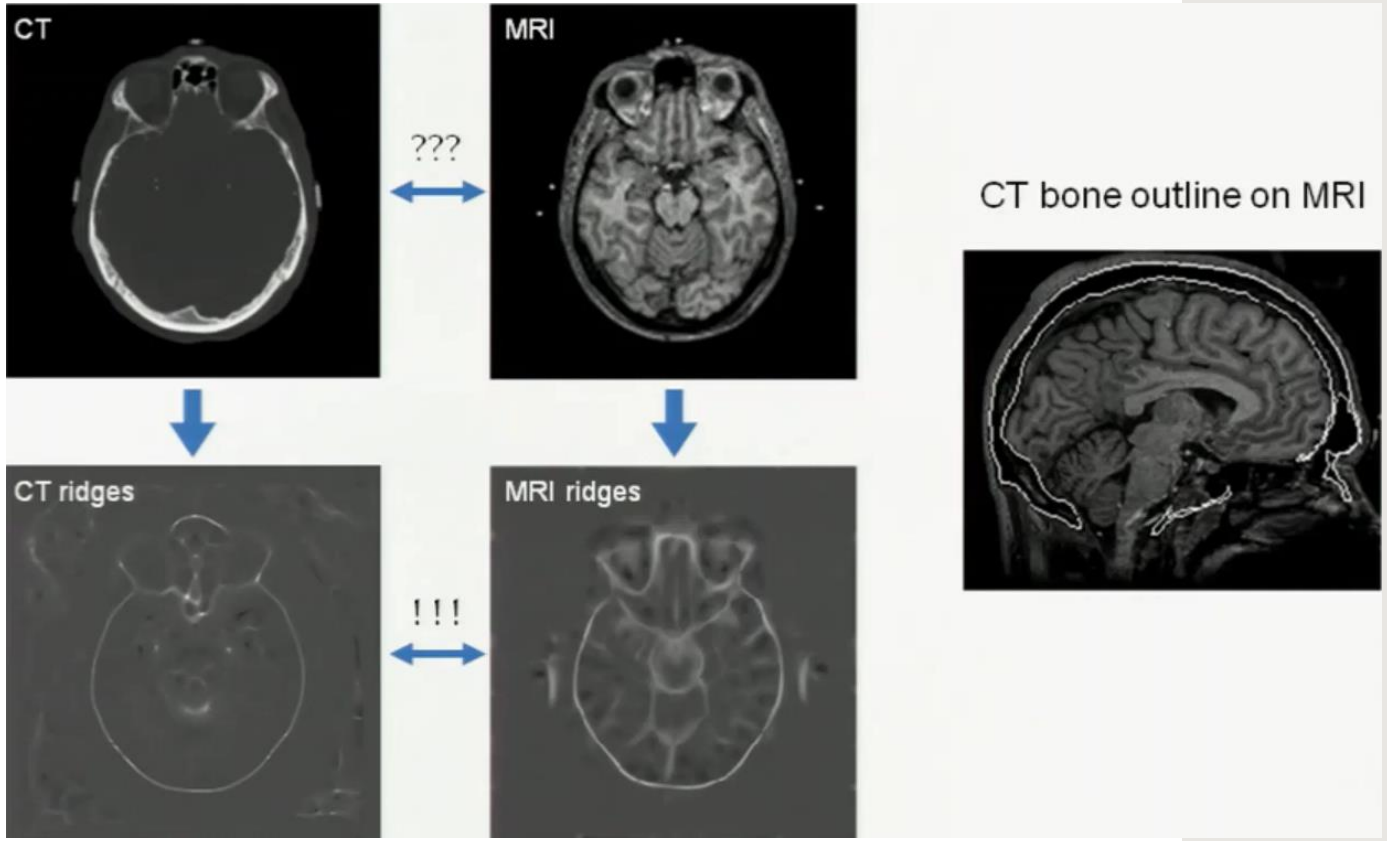
$$J(x,y) = I\big(T(x,y)\big) \Rightarrow I(c_x \times x, c_y \times y)$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} c_x & 0 \\ 0 & c_y \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

DARTEL： Diffeomorphic Anatomical Registration Through Exponential Lie Algebra

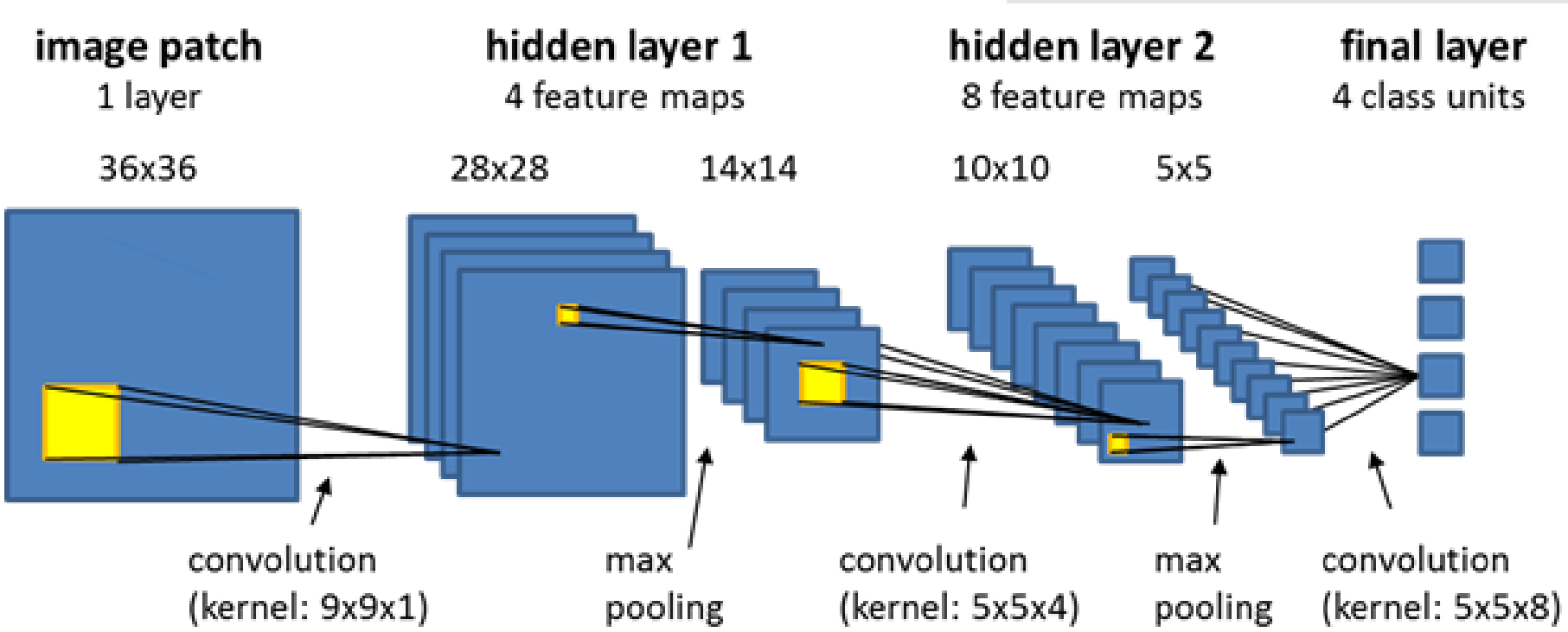


Transformation is the key

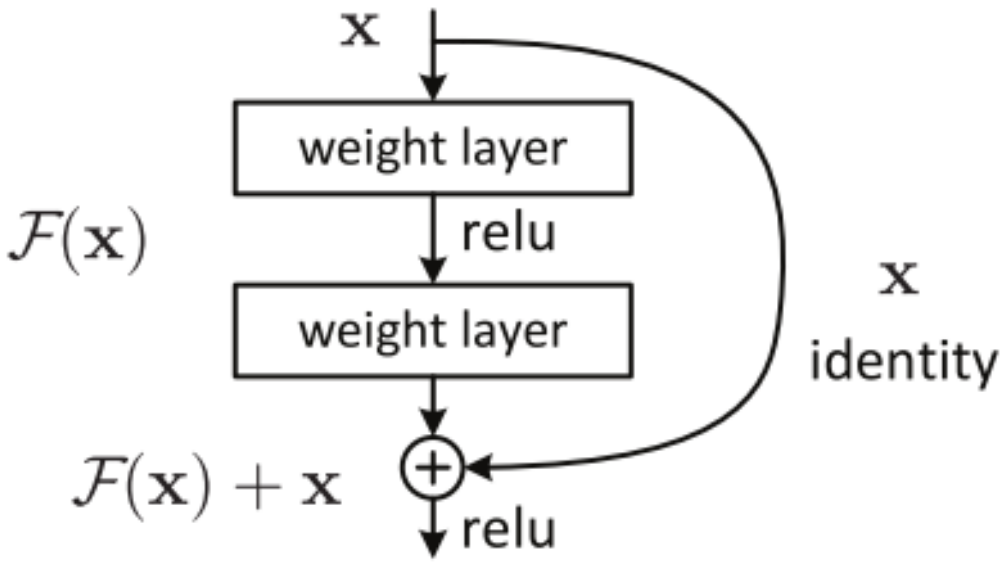


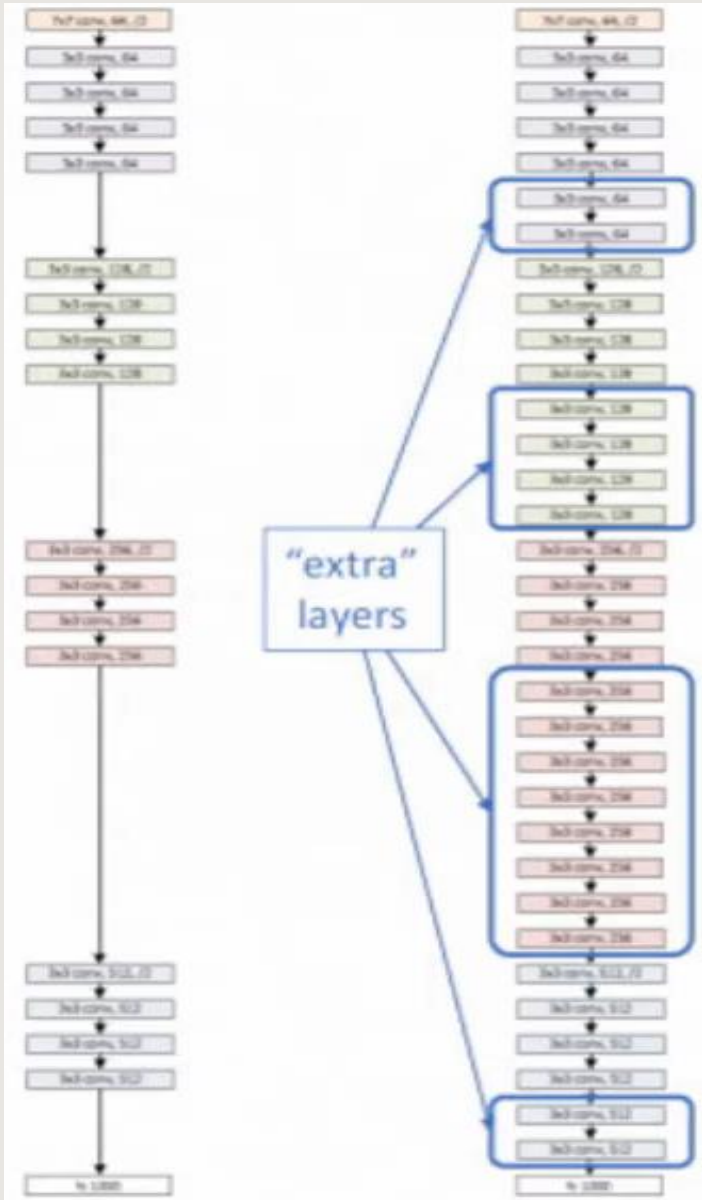
CT bone outline on MRI

Convolution neural networks (CNN)



ResNet (Residual Network)





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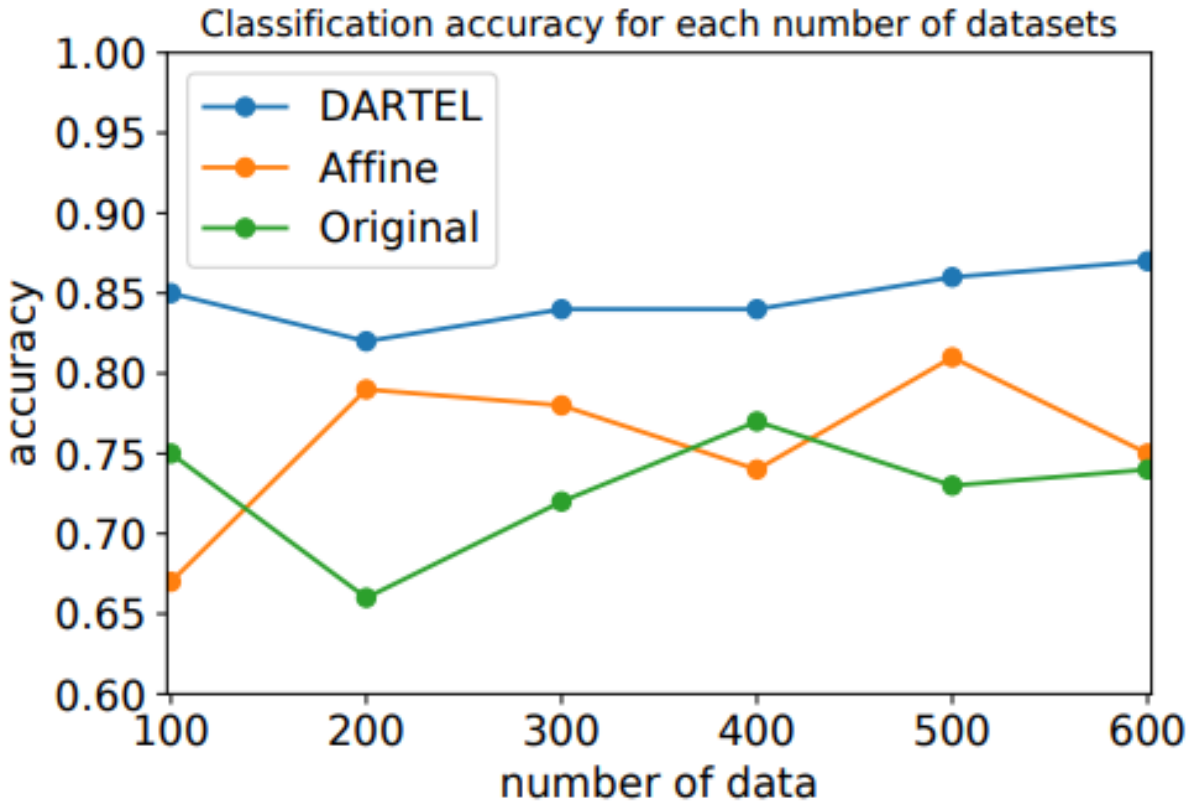
Result


Classification accuracy for each number of datasets
DARTEL
Affine
Original
accuracy
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
100
200
300
400
500
600
number of data

Reference

An effective combination of pre-processing technique and … (n.d.). Retrieved April 15, 2022,
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