

A neural network model in hepatitis diagnosis

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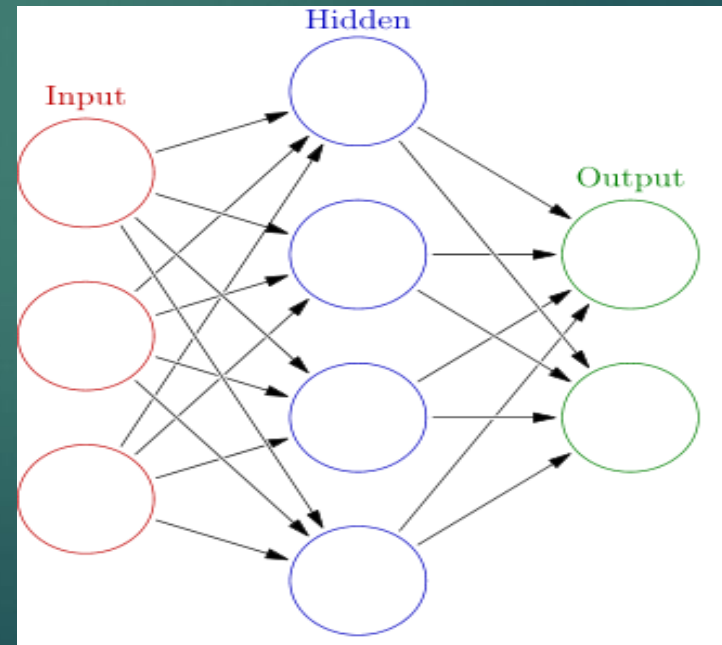
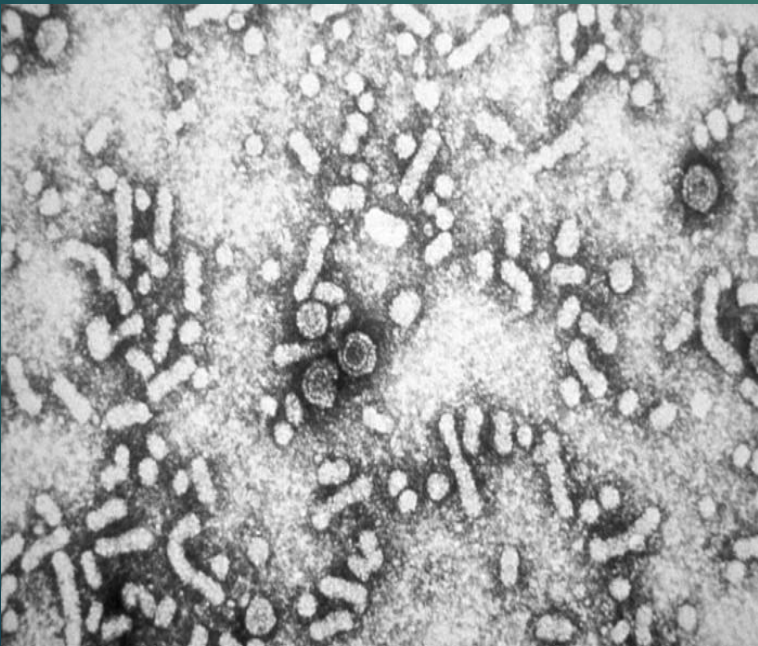
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Background knowledge

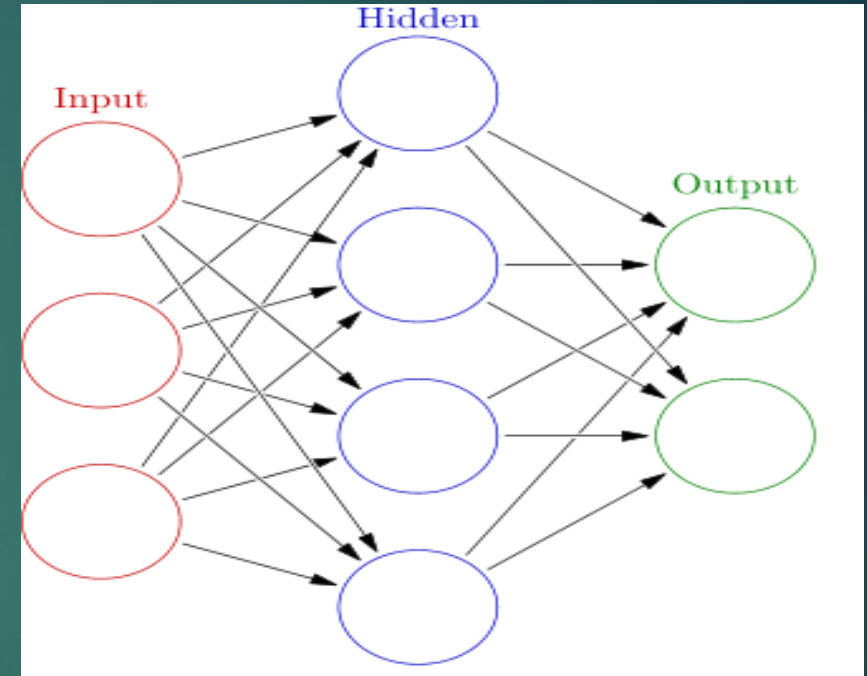
- ▶ About hepatitis
- ▶ NN in hepatitis diagnosis



NN in hepatitis diagnosis



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Research Purpose



1.

Build a high accuracy
NN model



2.

Find the influential features
and their correlations

NN model overview

- ▶ Data set :UCI machine learning database with data of 19 physical and medical features of 155 sampled hepatitis patients.
- ▶ Classification result: die(life-threatening), live(not life-threatening)
- ▶ NN models :

Research	Model
Ozyilmaz and Yildirim (2003)	MLNN with BP learning algorithm
Ozyilmaz and Yildirim (2003)	RBF structure trained by the OLS algorithm
Ansari et al. (2011)	GRNN structure model
Bascil and Temurtas(2009)	MLNN model with the LM learning algorithm
Çetin et al. (2015)	MLNN model with the approximations of sigmoid activation function

NN model overview(continued)

Model	Architecture	Learning algorithm	Activation function	Accuracy
MLNN with BP	MLNN	BP	sigmoid	81.375%
RBF with OSL	RBF	OSL	sigmoid	85%
GRNN	GRNN	GRNN	Gaussian	92%
MLNN with LM	MLNN	LM	Sigmoid	91.87%/93%
MLNN with LM using approximations of sigmoid activation function	MLNN	LM	A simple polynomial function	91.8%
			A piecewise function	92.5%
			A Taylor series expansion	93.1%

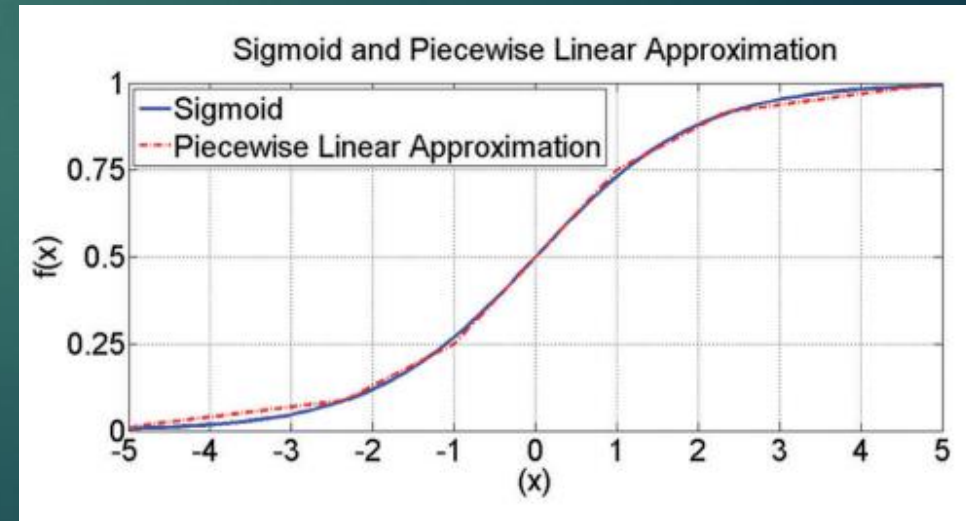
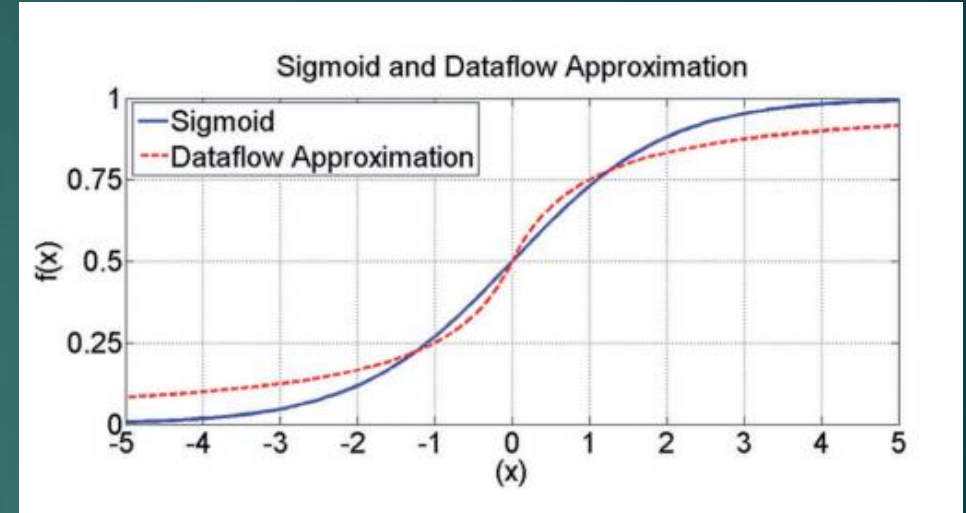
Three approximations of sigmoid activation function

- ▶ A simple polynomial function:

$$y = \frac{1}{2} \left(\frac{x}{1 + |x|} + 1 \right)$$

- ▶ A piecewise function:

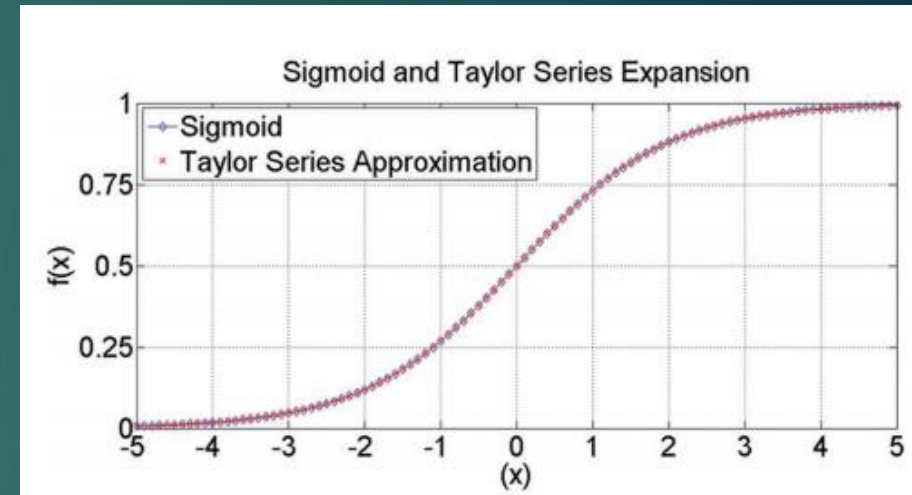
$Y = 1$	$ X \geq 5$
$Y = 0.03125 \cdot X $	$2.375 \leq X < 5$
$Y = 0.125 \cdot X + 0.625$	$1 \leq X < 2.375$
$Y = 0.25 \cdot X + 0.5$	$0 \leq X < 1$
$Y = 1 - Y$	$ X < 0$



Three approximations of sigmoid activation function(continued)

► A Taylor series expansion

$$y = \begin{cases} 0.571859 + (0.392773)x + (0.108706)x^2 + (0.014222)x^3 + (0.000734)x^4 & -\infty < x \leq -1.5 \\ \frac{1}{2} + \frac{1}{4}x - \frac{1}{48}x^3 + \frac{1}{480}x^5 & -1.5 < x < 1.5 \\ 0.428141 + (0.392773)x + (0.108706)x^2 + (0.014222)x^3 - (0.00734)x^4 & 1.5 \leq x < \infty \end{cases}$$



Çetin et al. (2015)

Performance evaluation

- ▶ The MLNN model with the standard BP algorithm has the least accuracy compared with other NN models.
- ▶ The RBF and GRNN performs better in the hepatitis diagnosis and both of them are based on one pass algorithm.
- ▶ The LM algorithm provides a high accuracy in diagnosing hepatitis for its faster convergence and better estimation results than the BP algorithm.
- ▶ Use the approximation sigmoid activation functions to replace the sigmoid activation function has very important realistic meaning.

Our study — What we do

- ▶ Build the MLNN model with BP algorithm
- ▶ Use 5-fold cross-validation method to test accuracy of model
- ▶ Change the input features to see the diagnosis results
- ▶ Compare and find the influential features and correlations among them

Limitations and future improvement of Our Study

- ▶ Data set is small and incomplete
- ▶ Not best accuracy NN model chosen
- ▶ Not all possibility have been tested

Conclusion

- ▶ NN is a practical technology that deserves deeper study and wider development.
- ▶ The study of influential features of hepatitis diagnosis NN model is lacked.
- ▶ Our study is aimed to find the influential input features.
- ▶ A more efficient hepatitis diagnosis model will be built.

Reference List

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Thank You