MIME
Master's degree ICT Internet Multimedia Engineering

HUMAN DATA ANALYTICS: LAB 5

Instructor

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Lab. classes

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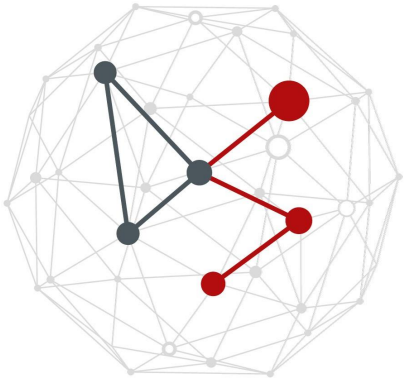

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

DIPARTIMENTO MATEMATICA

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UNIVERSITÀ DEGLI STUDI DI PADOVA

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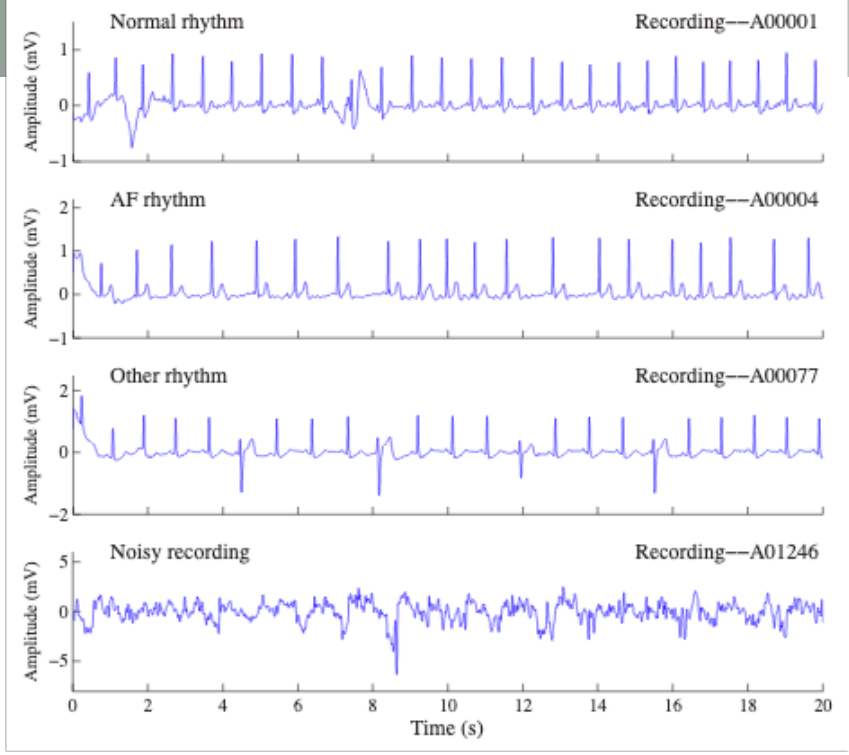
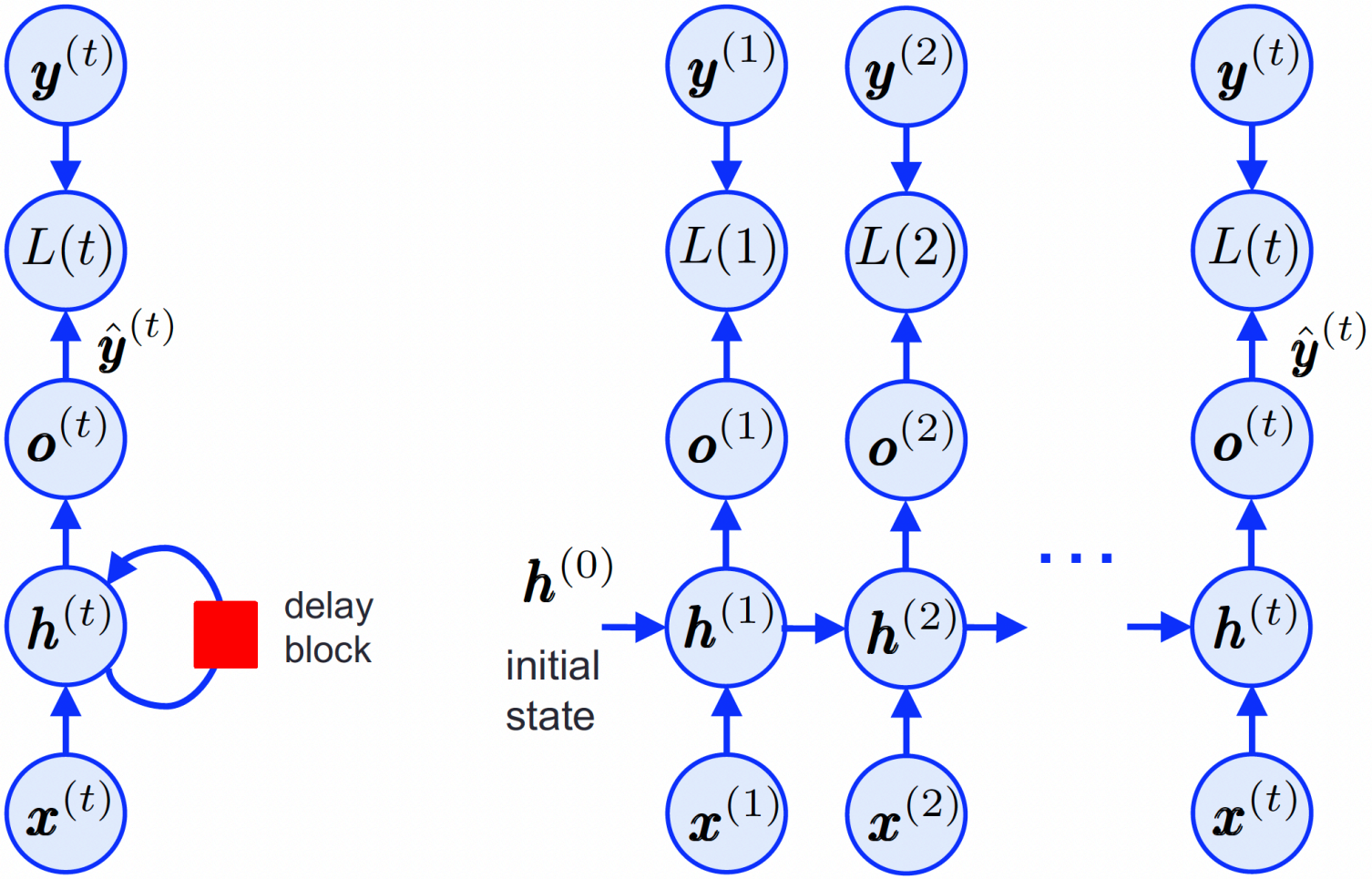


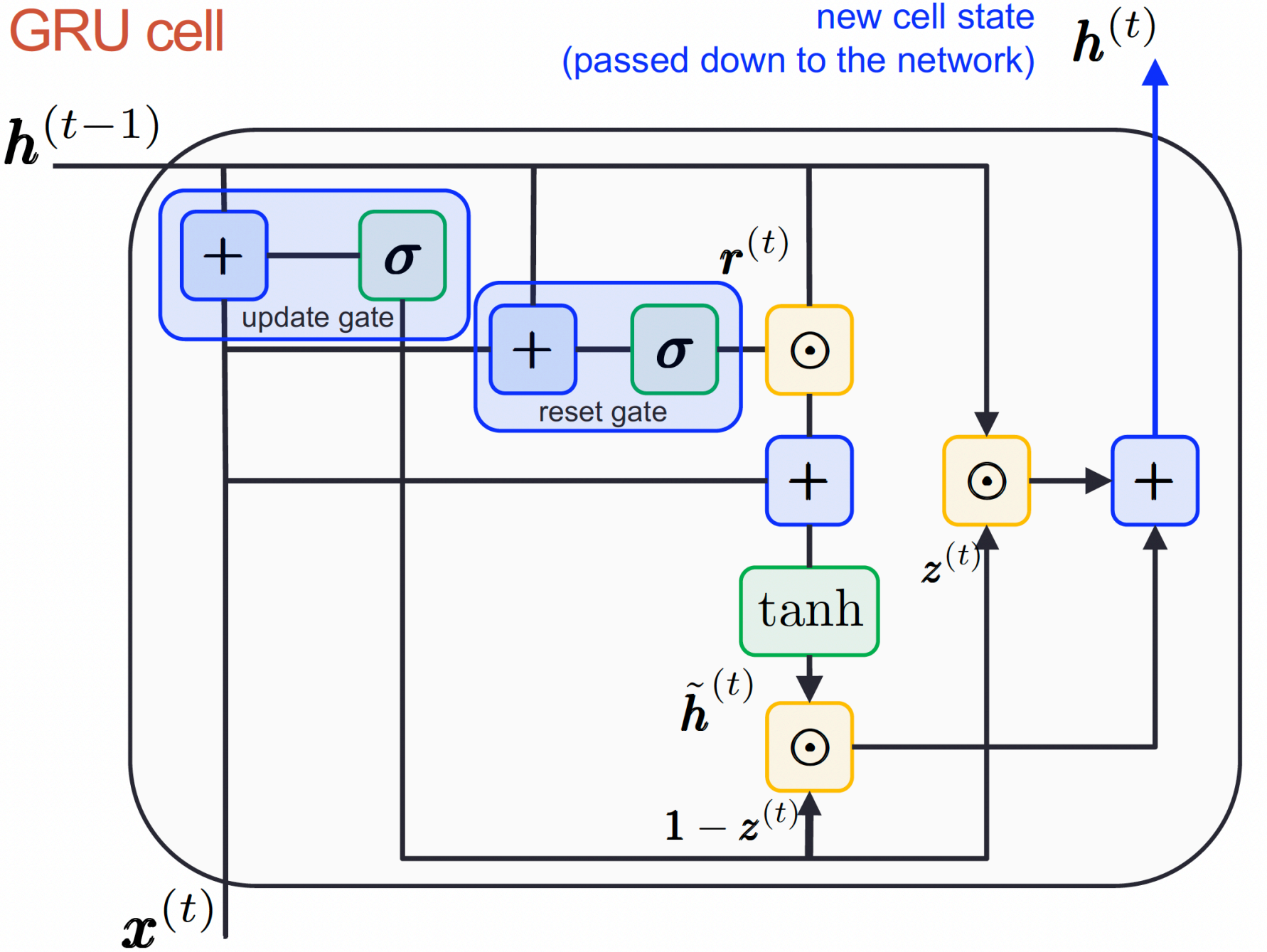
- CNN-RNN classifier
  - TensorFlow/Keras
  - The challenge:
    - abnormal heart rhythm recognition
  - You will learn to:
    - use Pandas Python library to handle data structures in Python
    - use Scikit-learn and SciPy Python libraries
    - preprocess the input data
    - implement a CNN-RNN based classifier using TensorFlow Keras
    - train the classifier and test its performance using different metrics

Reference from theory

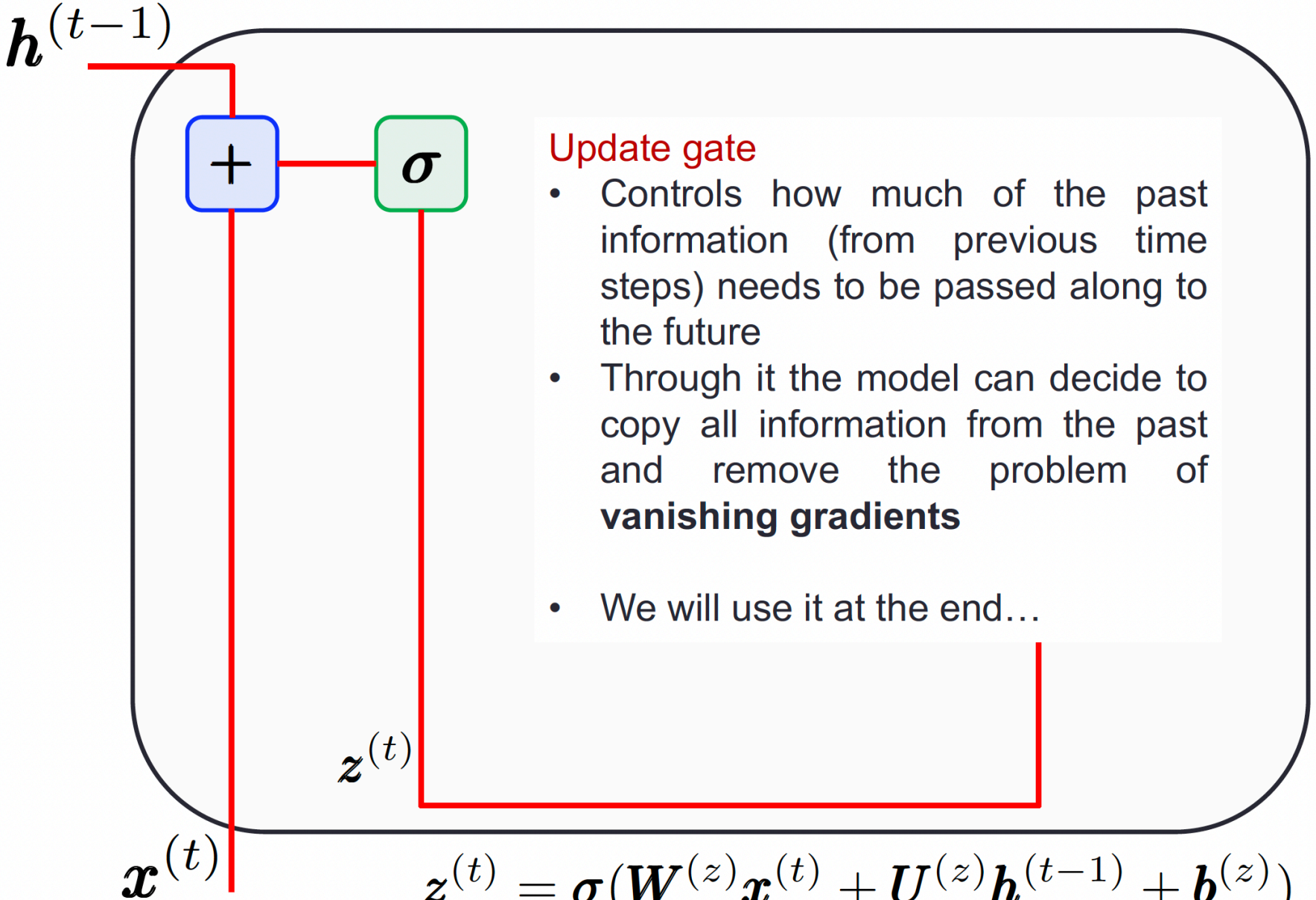
- LEARNING FOR SEQUENTIAL DATA: TOOLS AND APPLICATIONS



GRU cell


new cell state
(passed down to the network)
$h^{(t)}$
$h^{(t-1)}$
update gate
reset gate
$r^{(t)}$
$z^{(t)}$
tanh
$\tilde{h}^{(t)}$
$1 - z^{(t)}$
$x^{(t)}$

Step 1: update gate



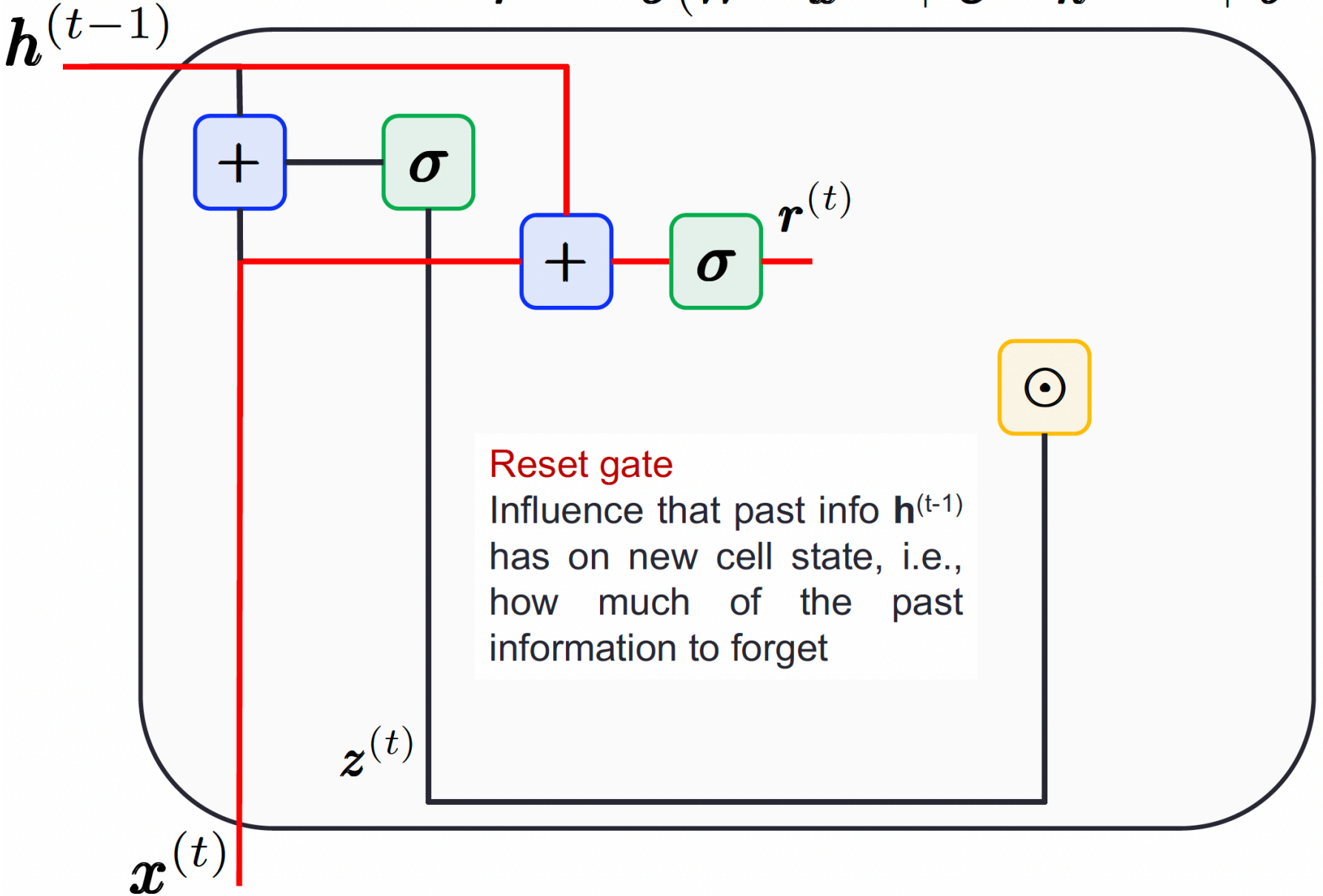
Update gate

- Controls how much of the past information (from previous time steps) needs to be passed along to the future
- Through it the model can decide to copy all information from the past and remove the problem of **vanishing gradients**
- We will use it at the end…

$$z^{(t)} = \sigma(W^{(z)}x^{(t)} + U^{(z)}h^{(t-1)} + b^{(z)})$$

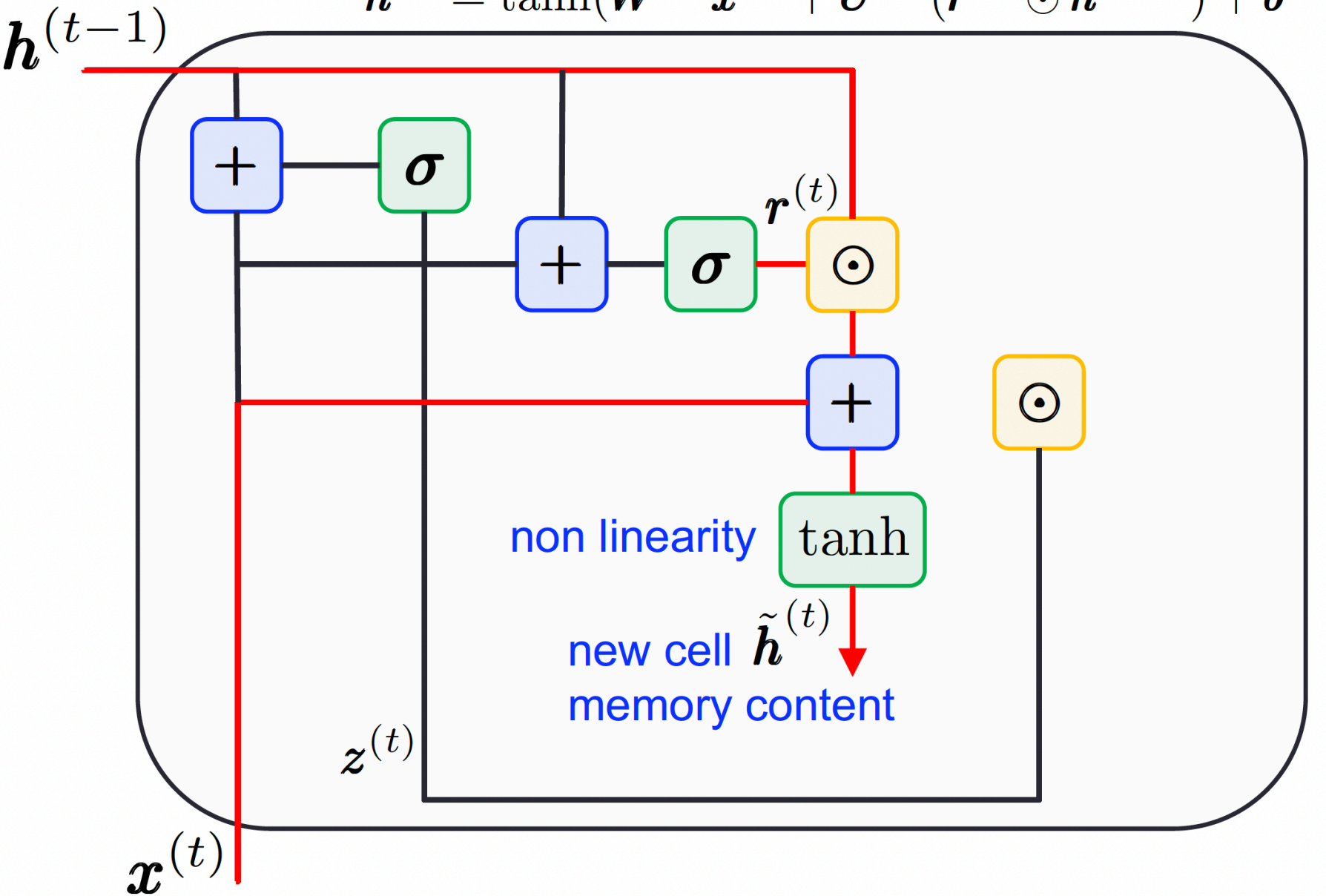
Step 2: reset gate

$$\boldsymbol{r}^{(t)} = \boldsymbol{\sigma}(\boldsymbol{W}^{(r)}\boldsymbol{x}^{(t)} + \boldsymbol{U}^{(r)}\boldsymbol{h}^{(t-1)} + \boldsymbol{b}^{(r)})$$



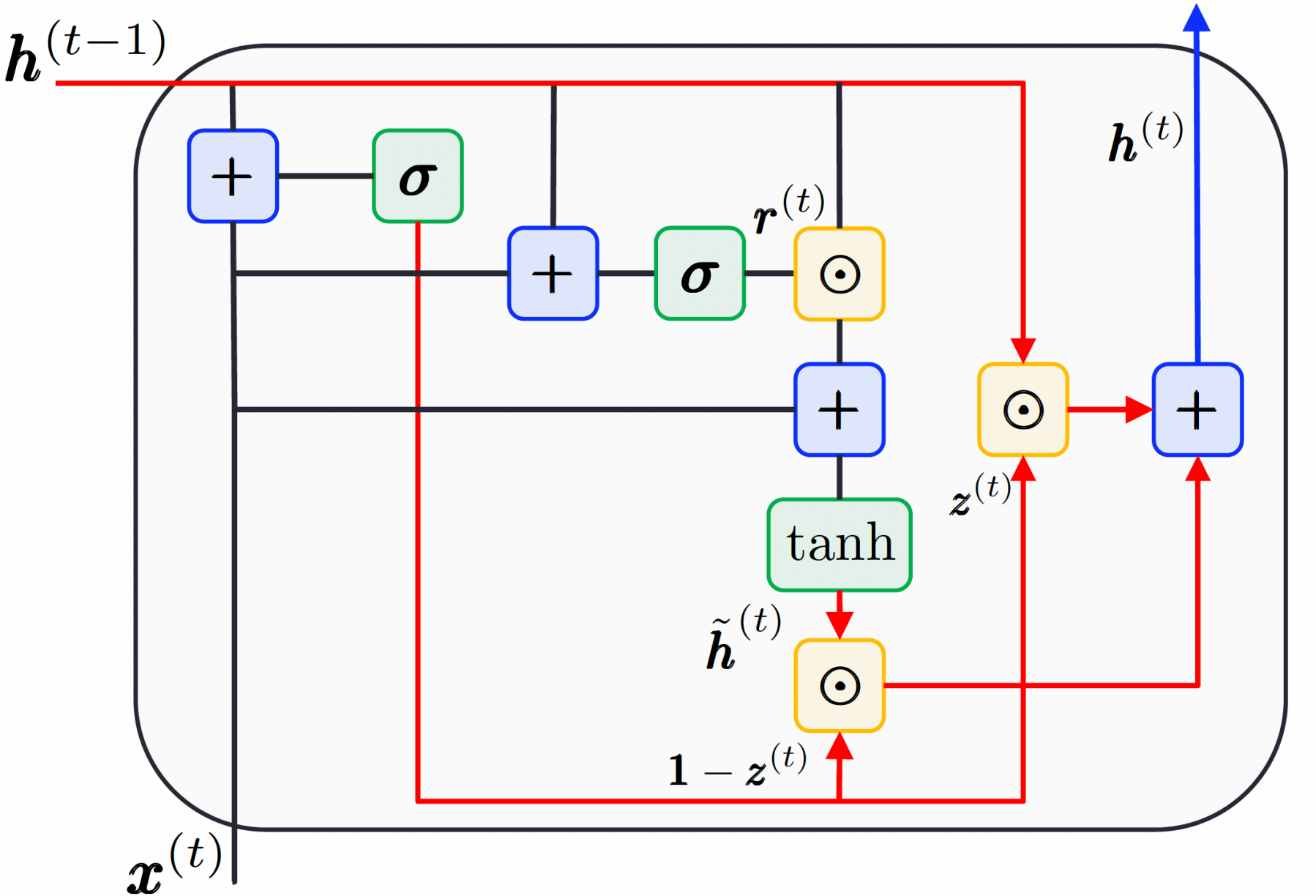
Step 3: current memory content

$$\tilde{\boldsymbol{h}}^{(t)} = \tanh(\boldsymbol{W}^{(h)}\boldsymbol{x}^{(t)} + \boldsymbol{U}^{(h)}(\boldsymbol{r}^{(t)} \odot \boldsymbol{h}^{(t-1)}) + \boldsymbol{b}^{(h)}$$



Step 4: final state

$$\boldsymbol{h}^{(t)} = \boldsymbol{z}^{(t)} \odot \boldsymbol{h}^{(t-1)} + (1 - \boldsymbol{z}^{(t)}) \odot \tilde{\boldsymbol{h}}^{(t}$$



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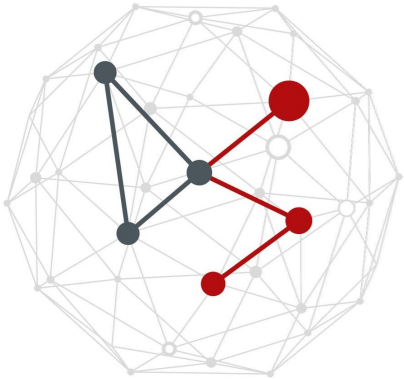

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