# An introduction to Recurrent Neural Networks

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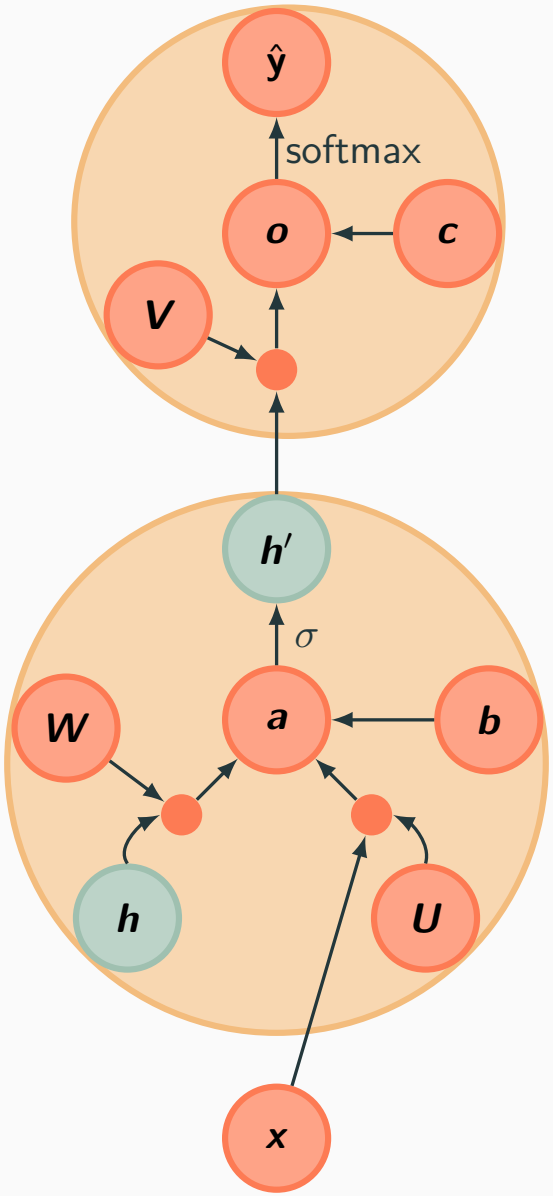
# RNN

# RNN as a graph



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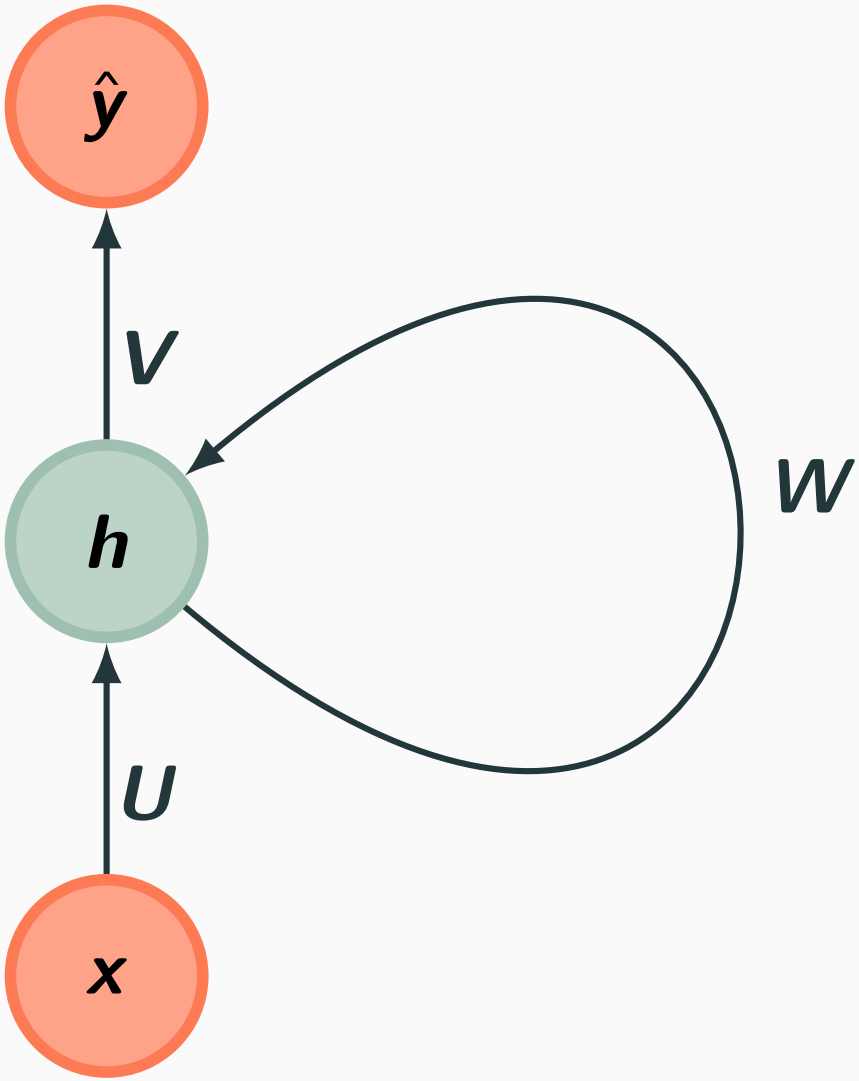
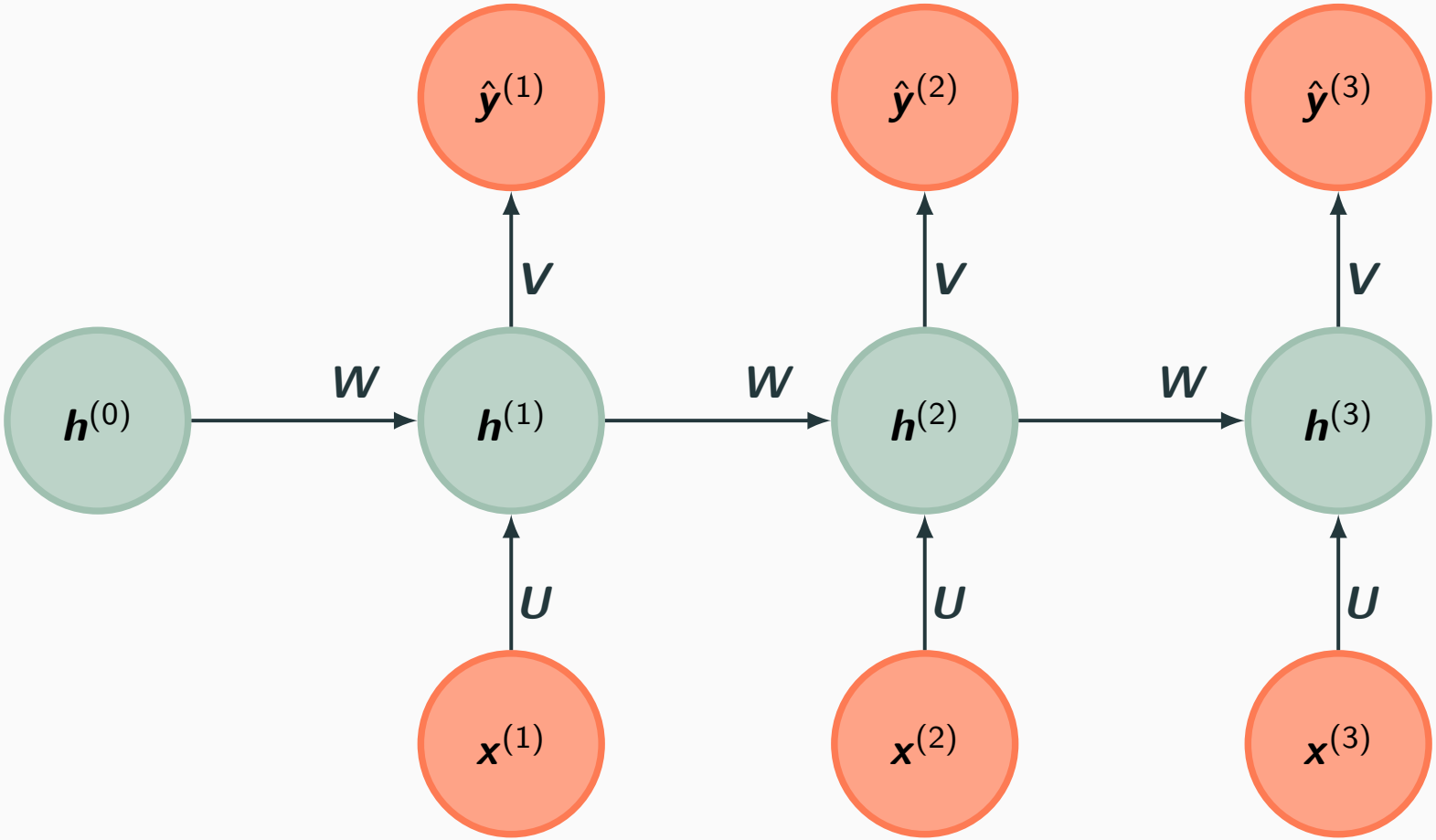
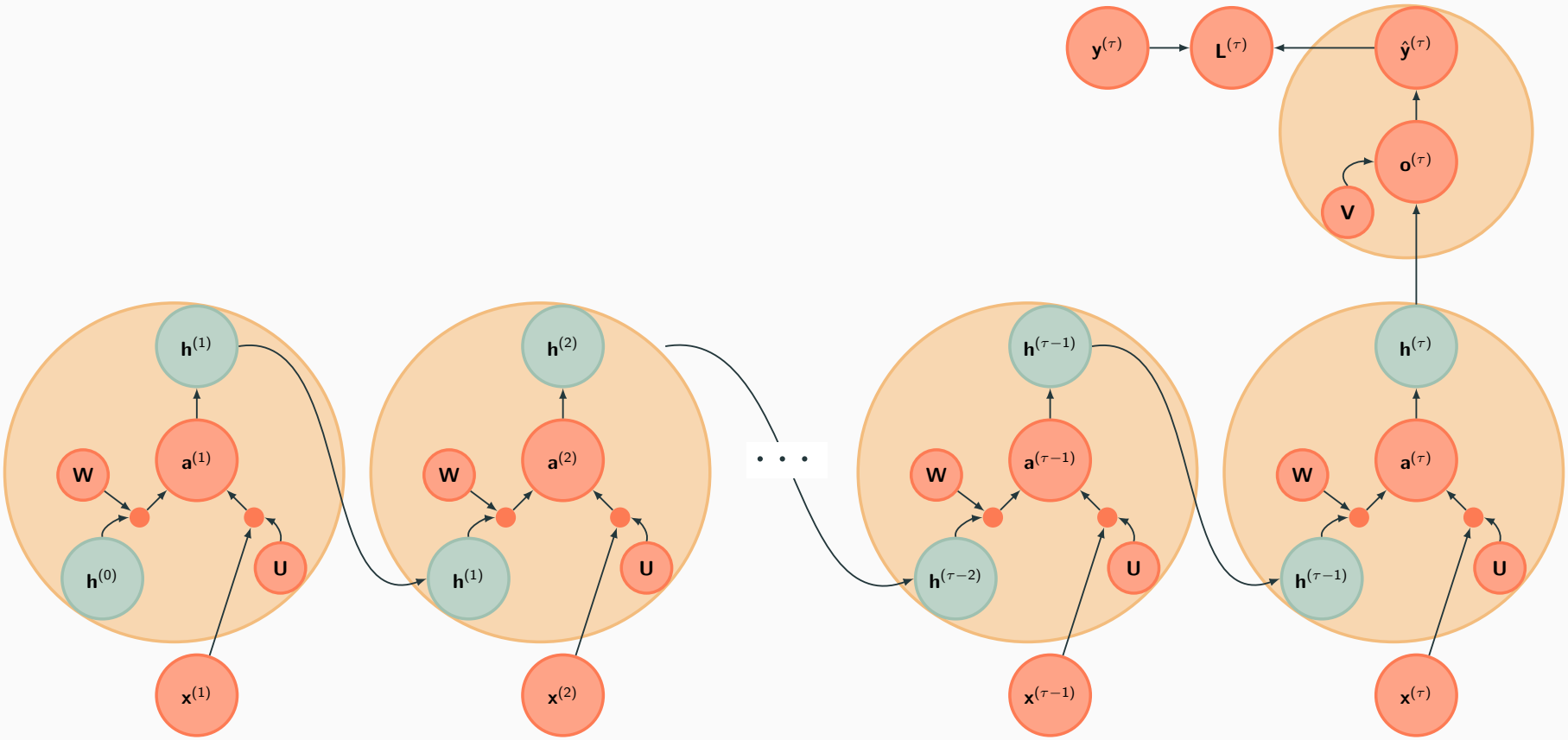


# Unfolding the graph

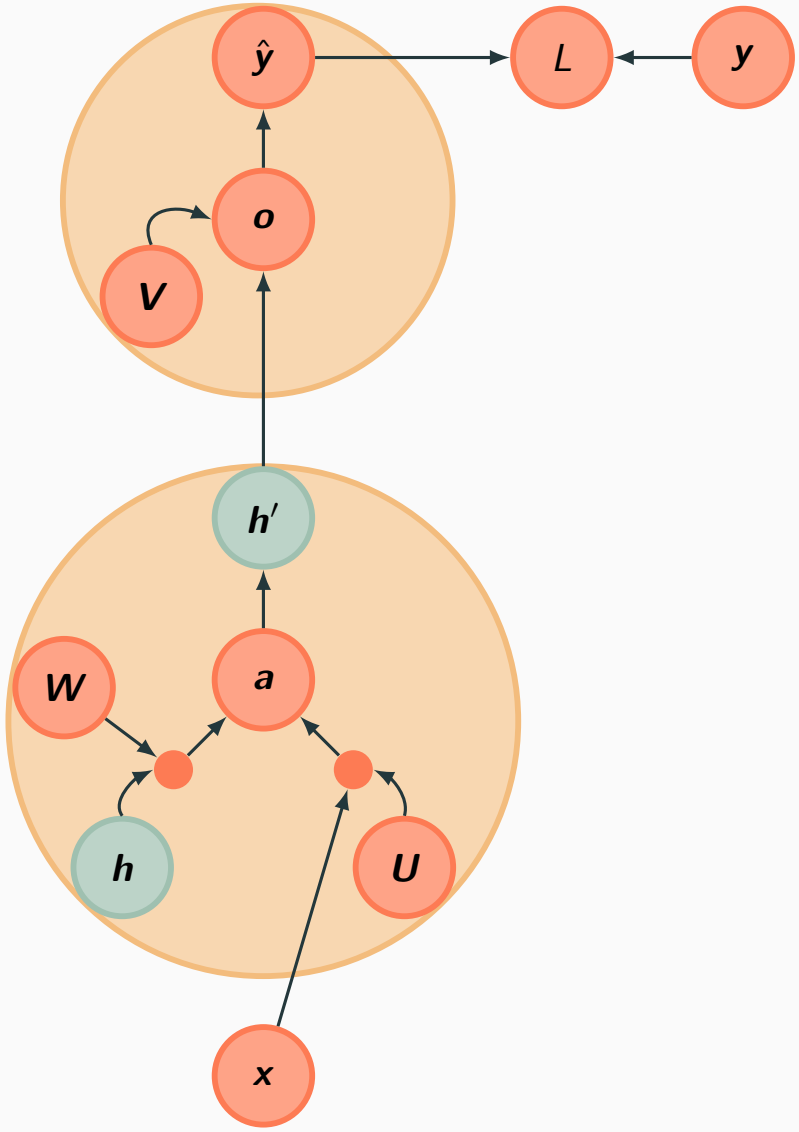


# RNN time unfolding



# BackPropagation

# Chain rule: RNN graph



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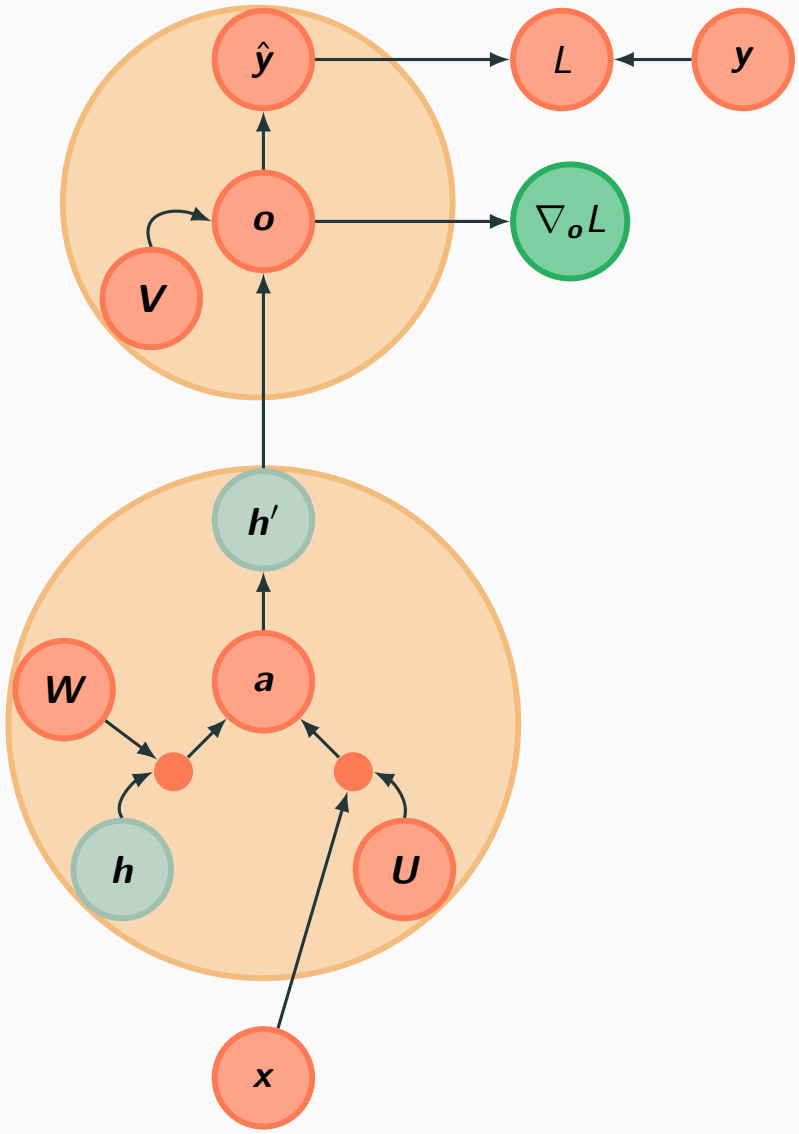

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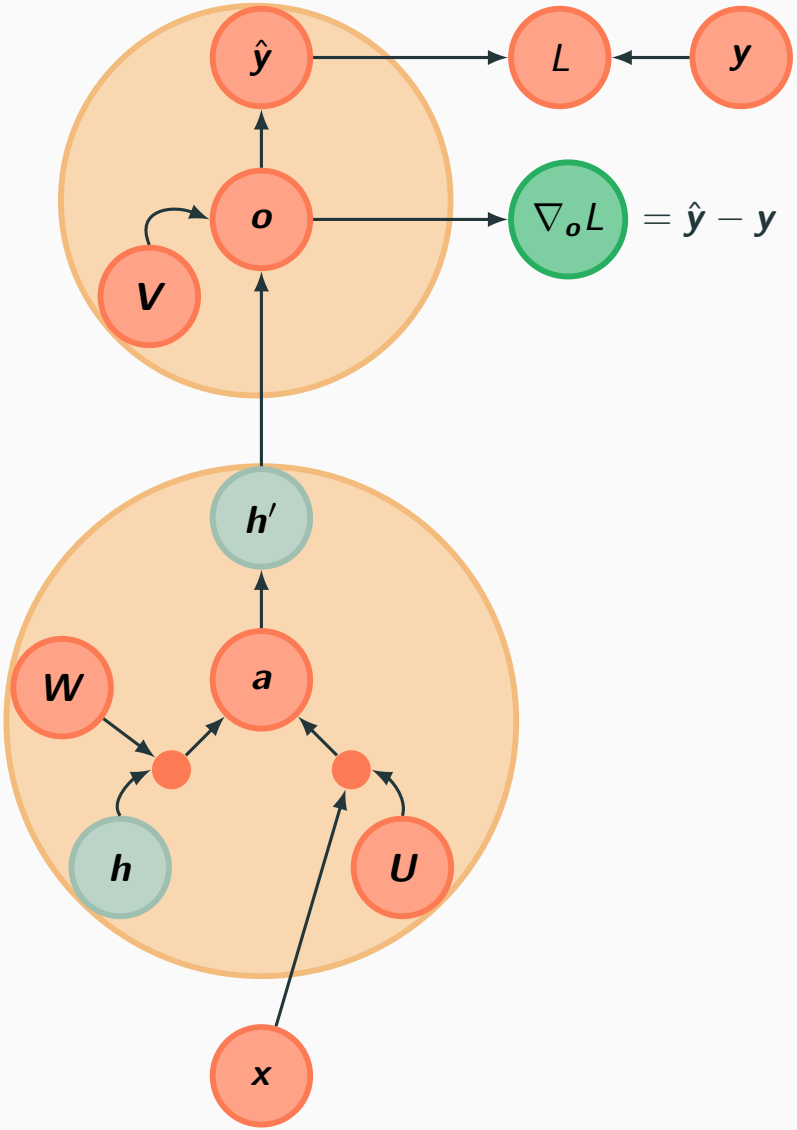

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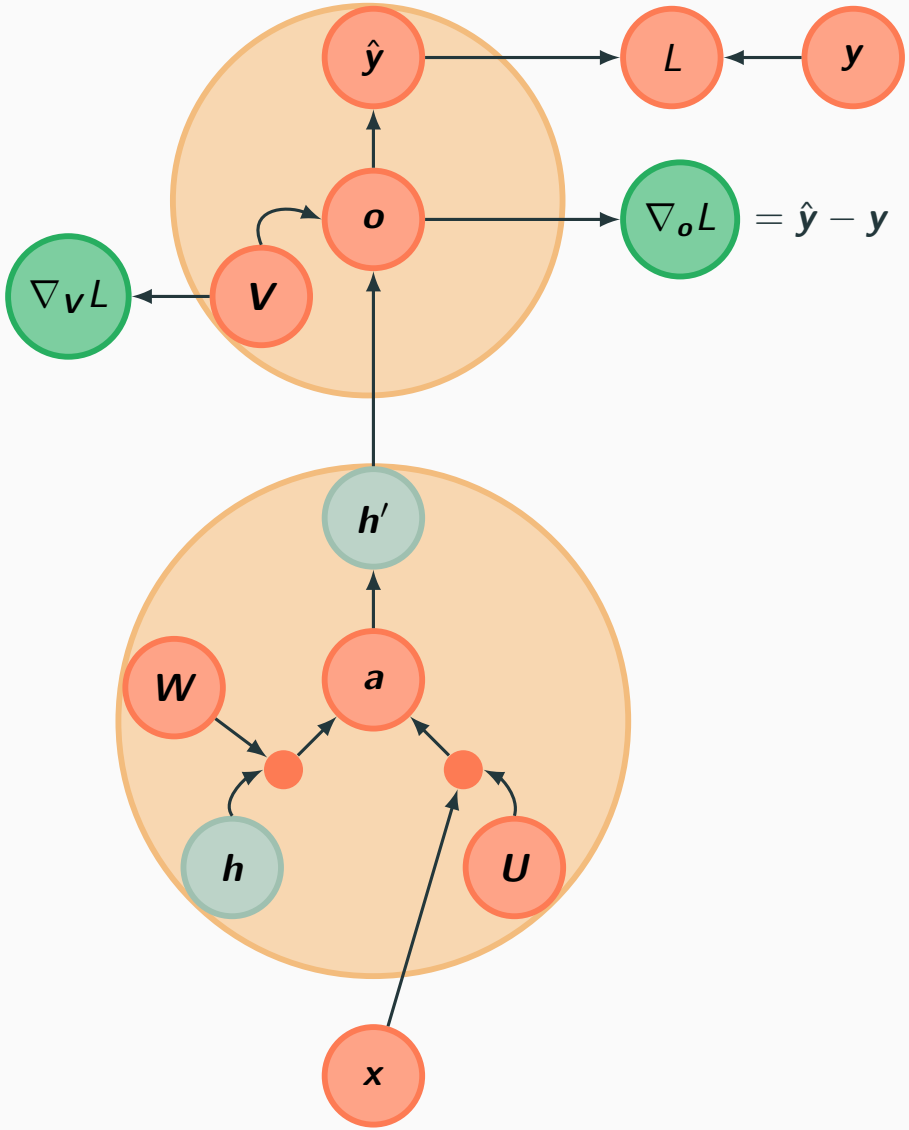

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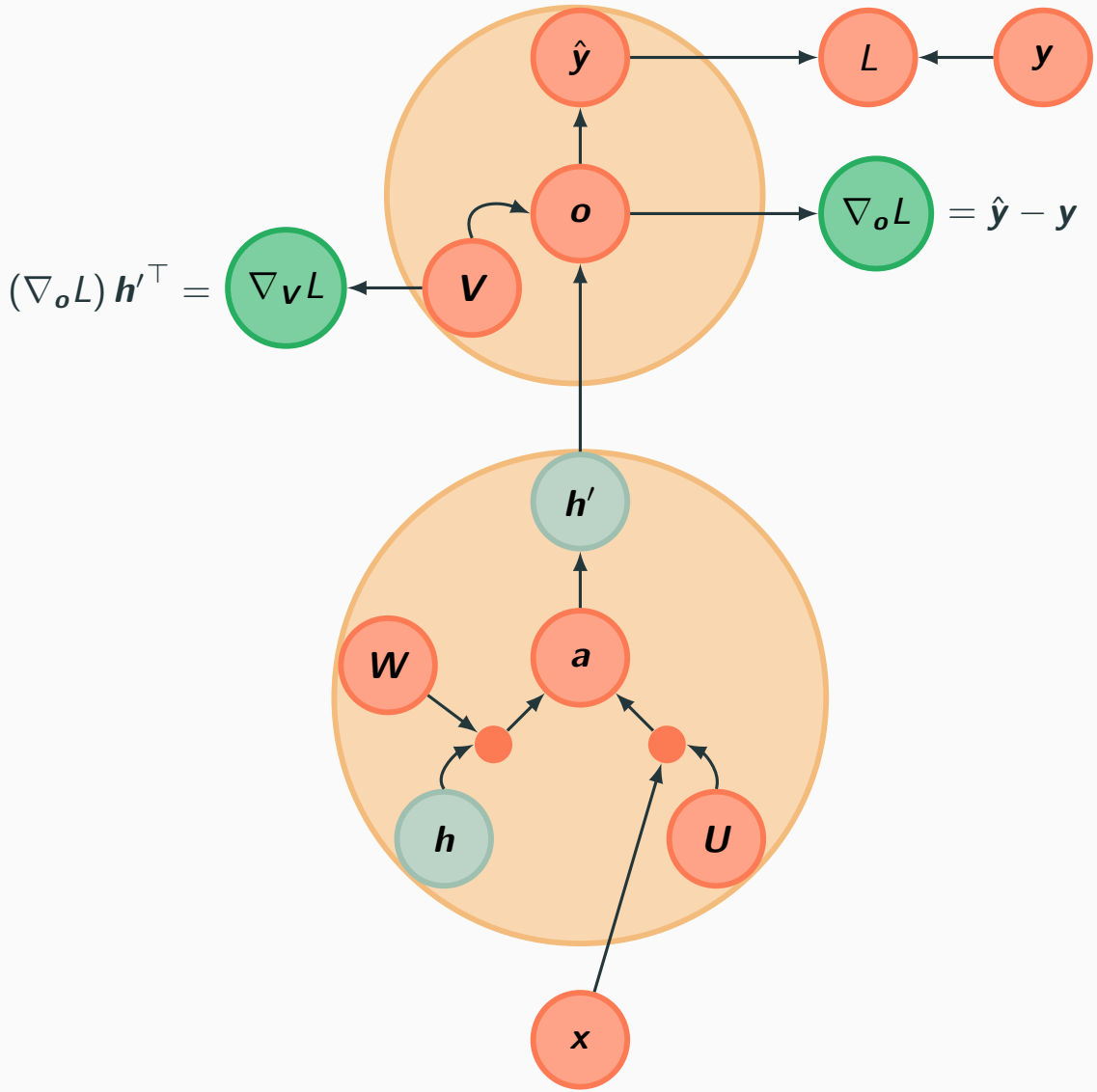

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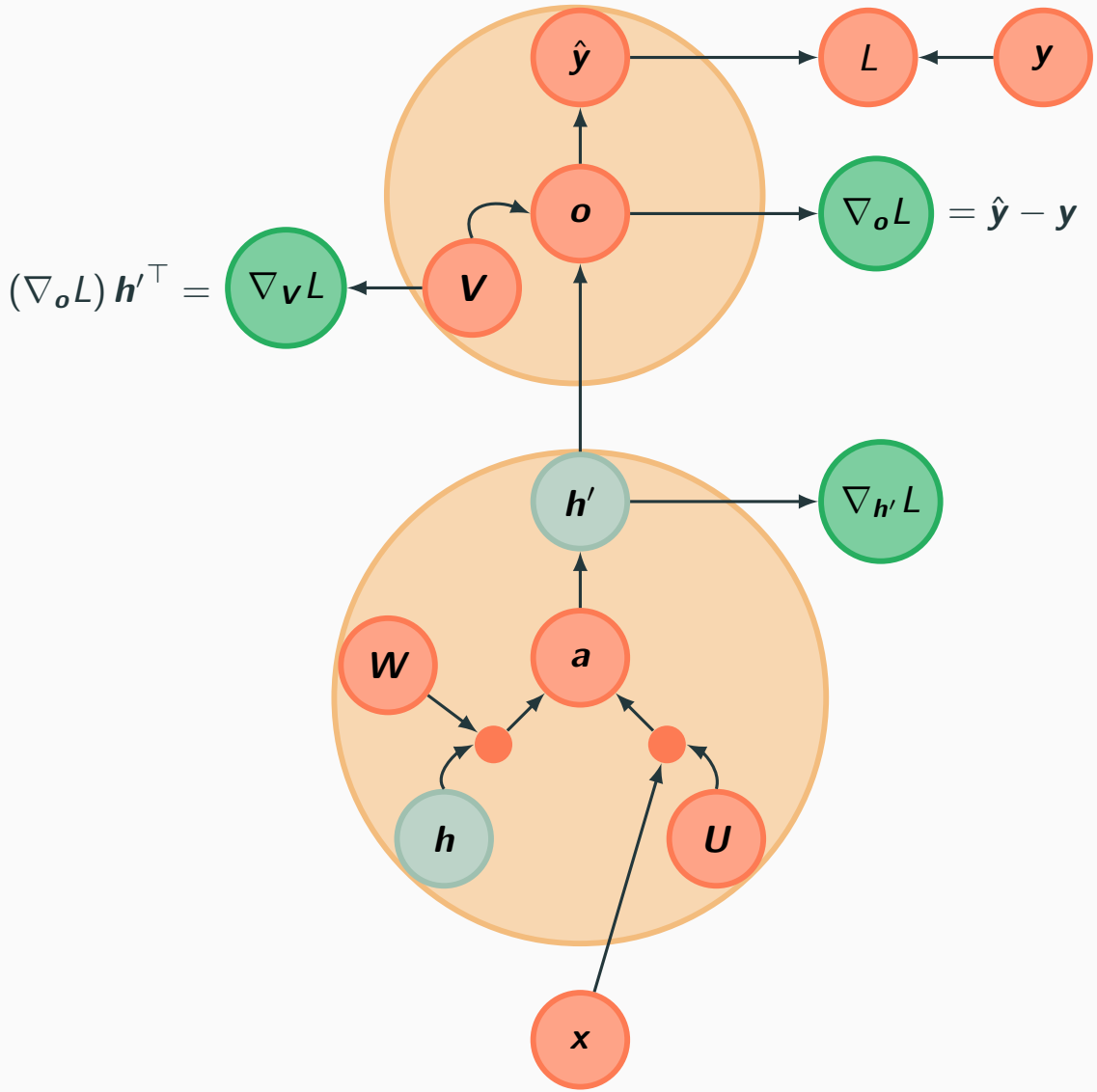

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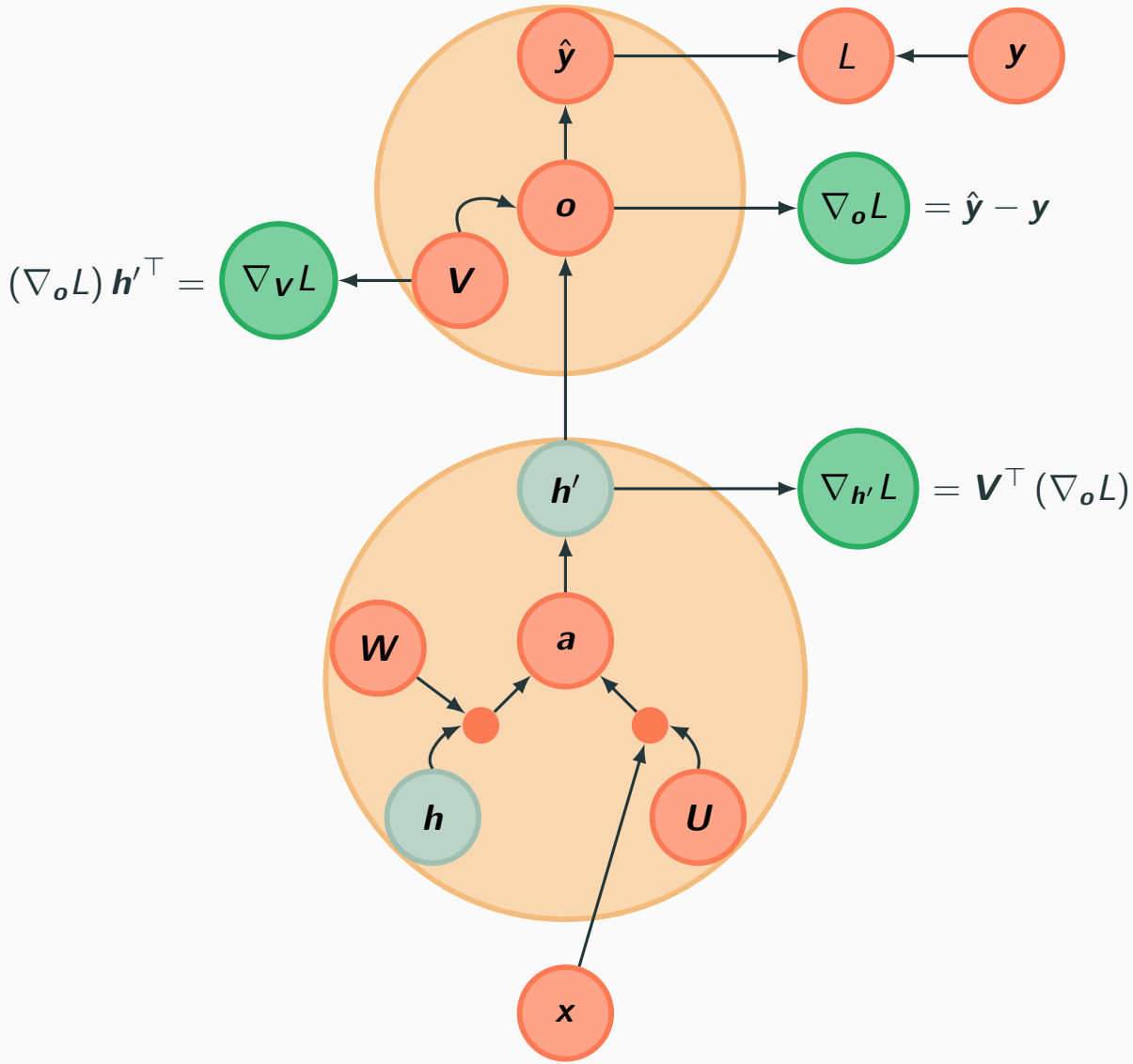

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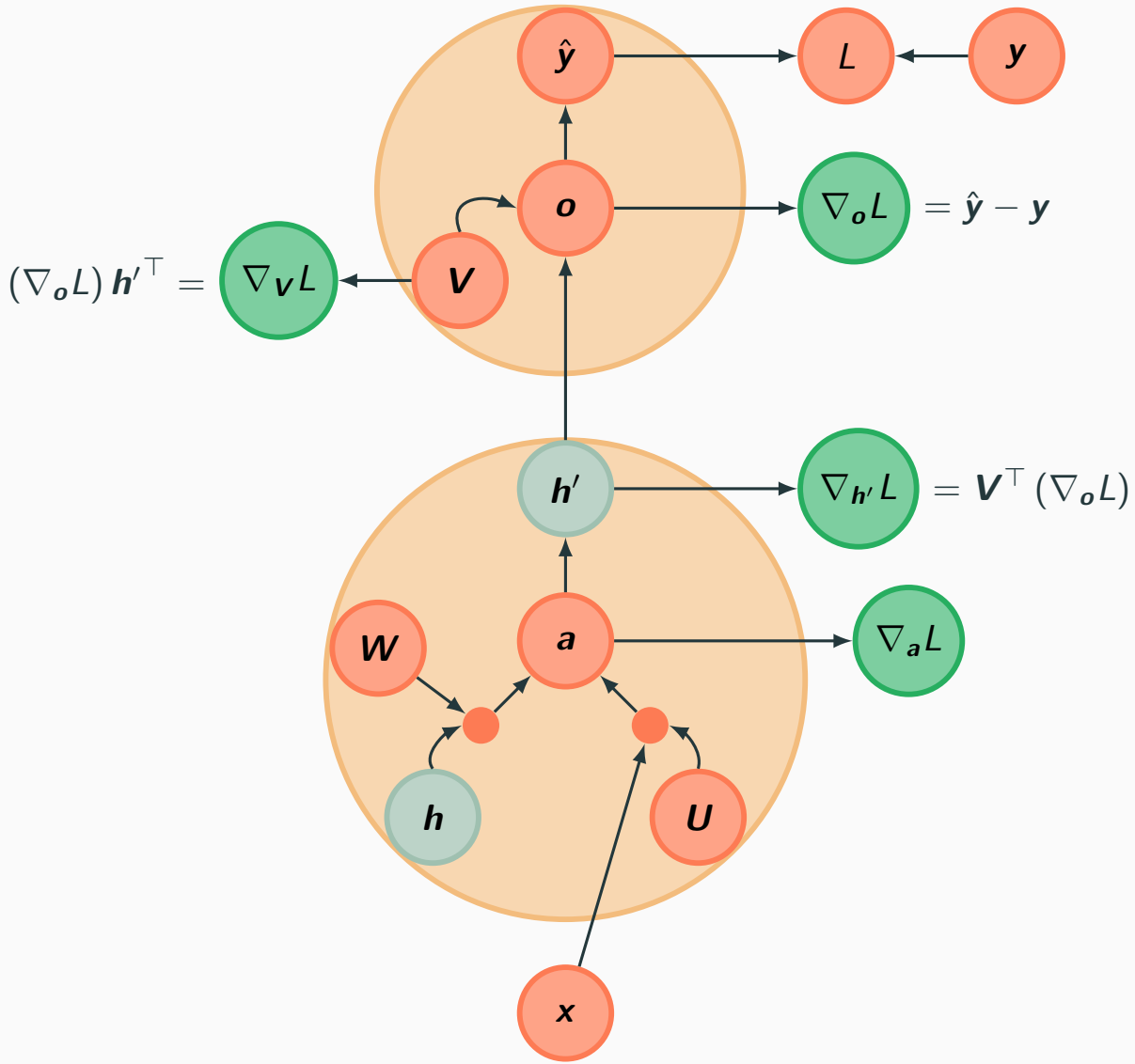

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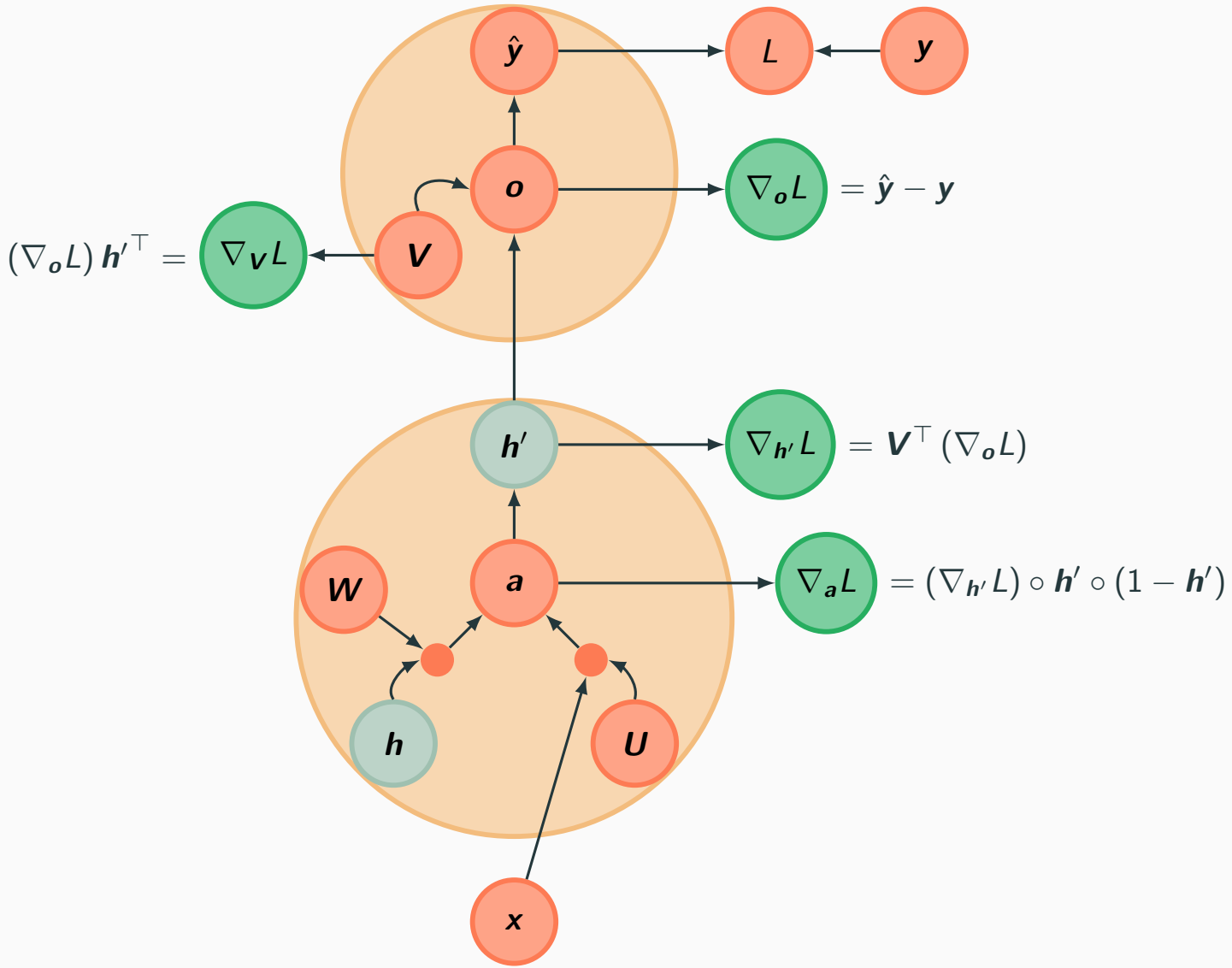

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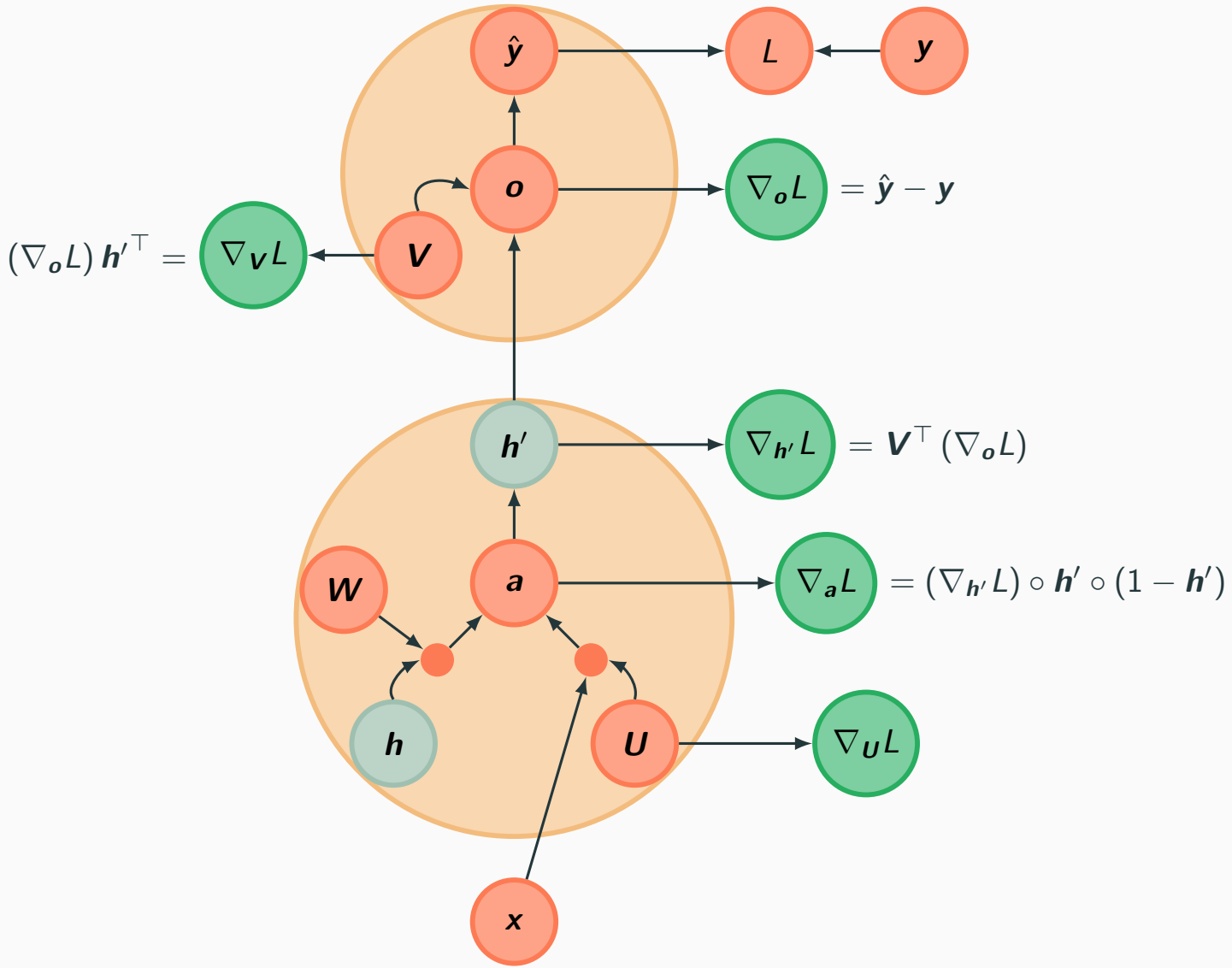

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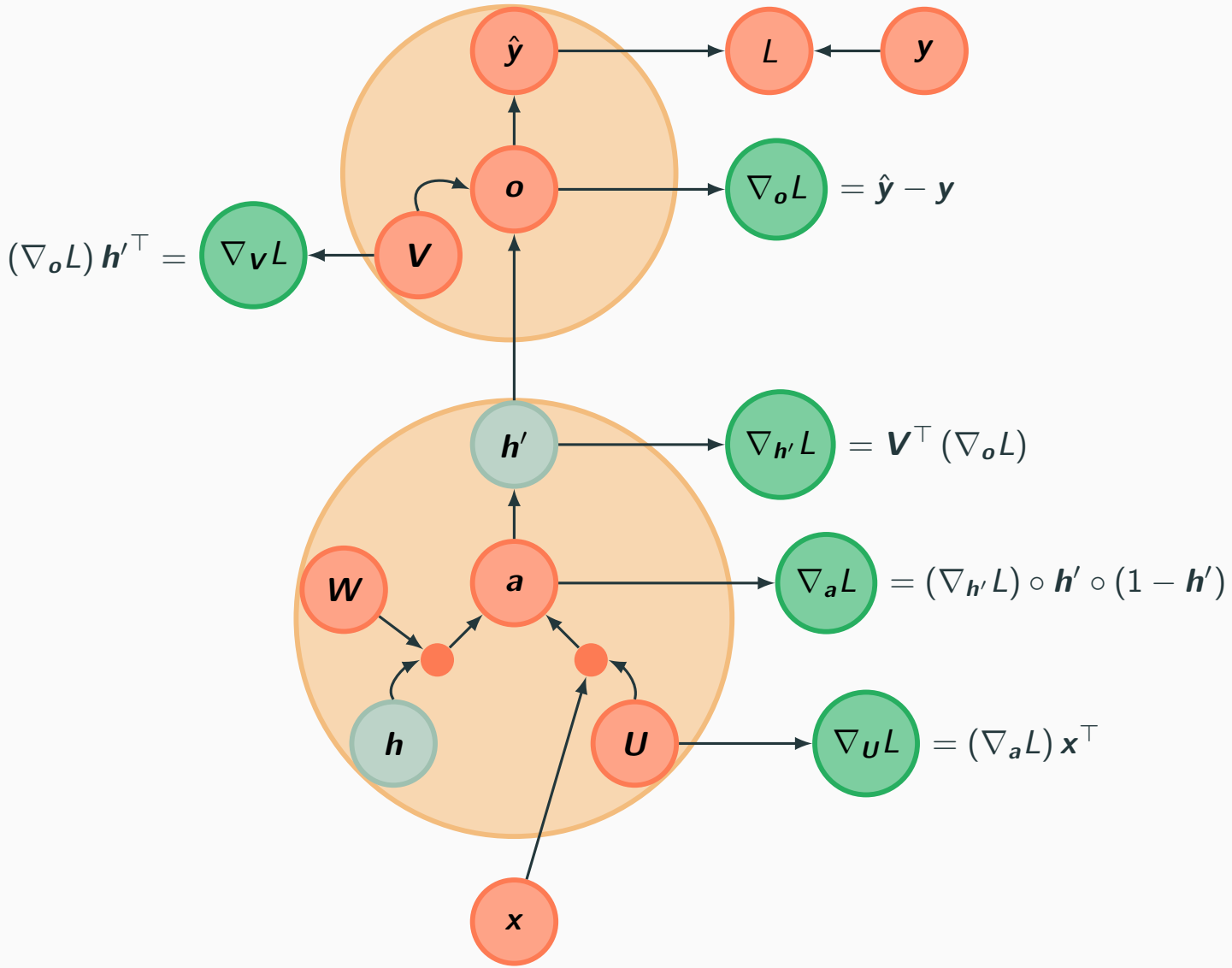

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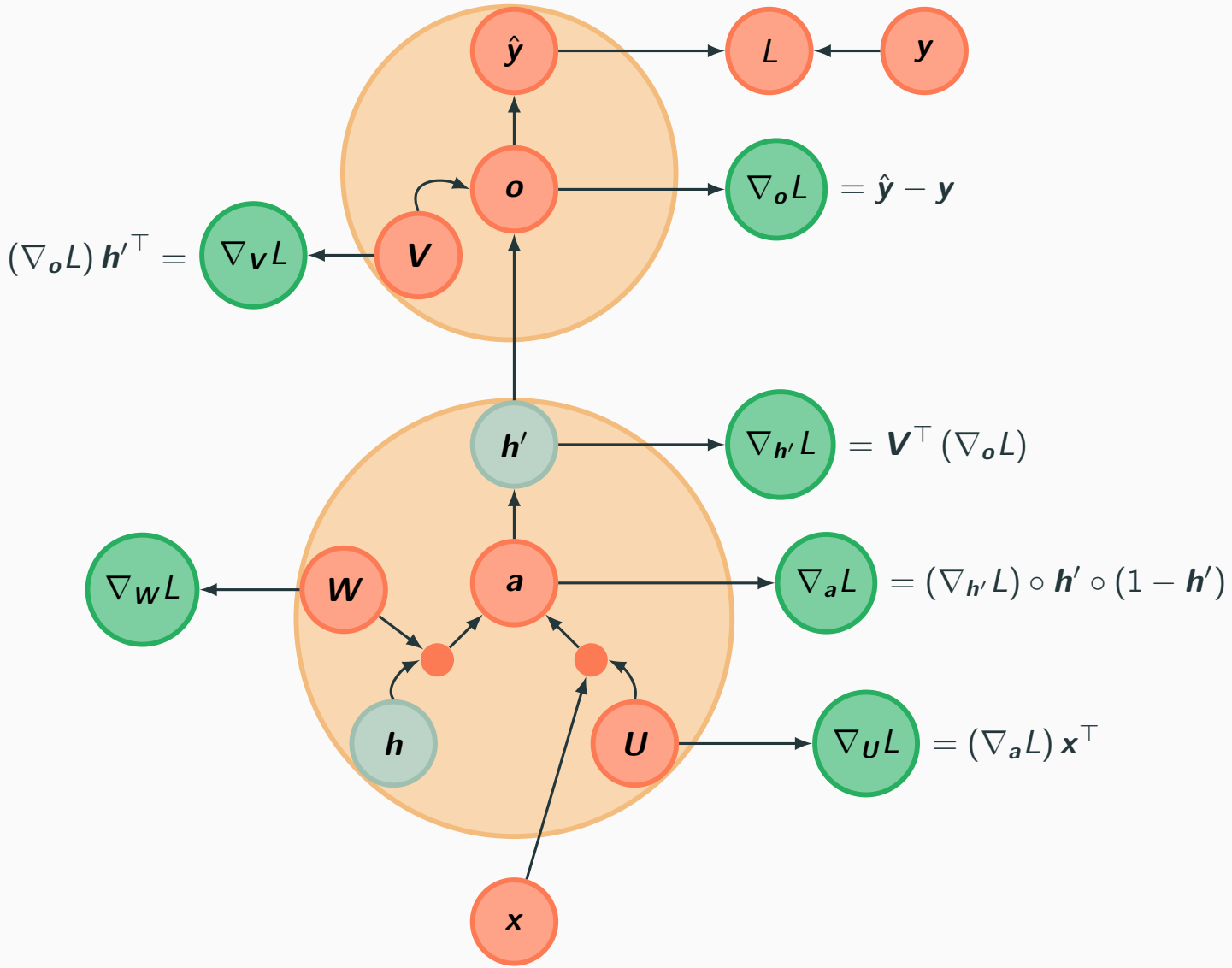

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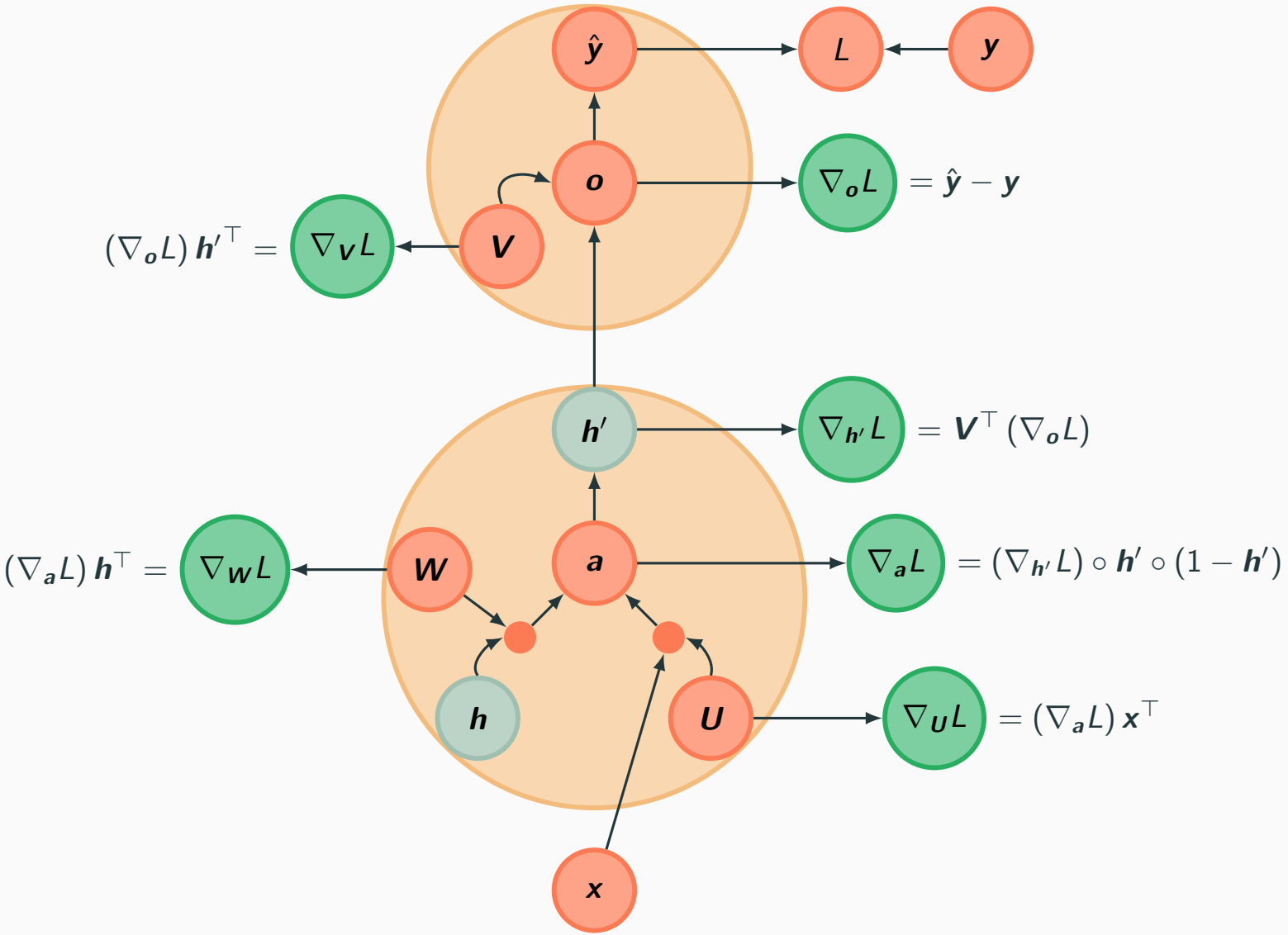

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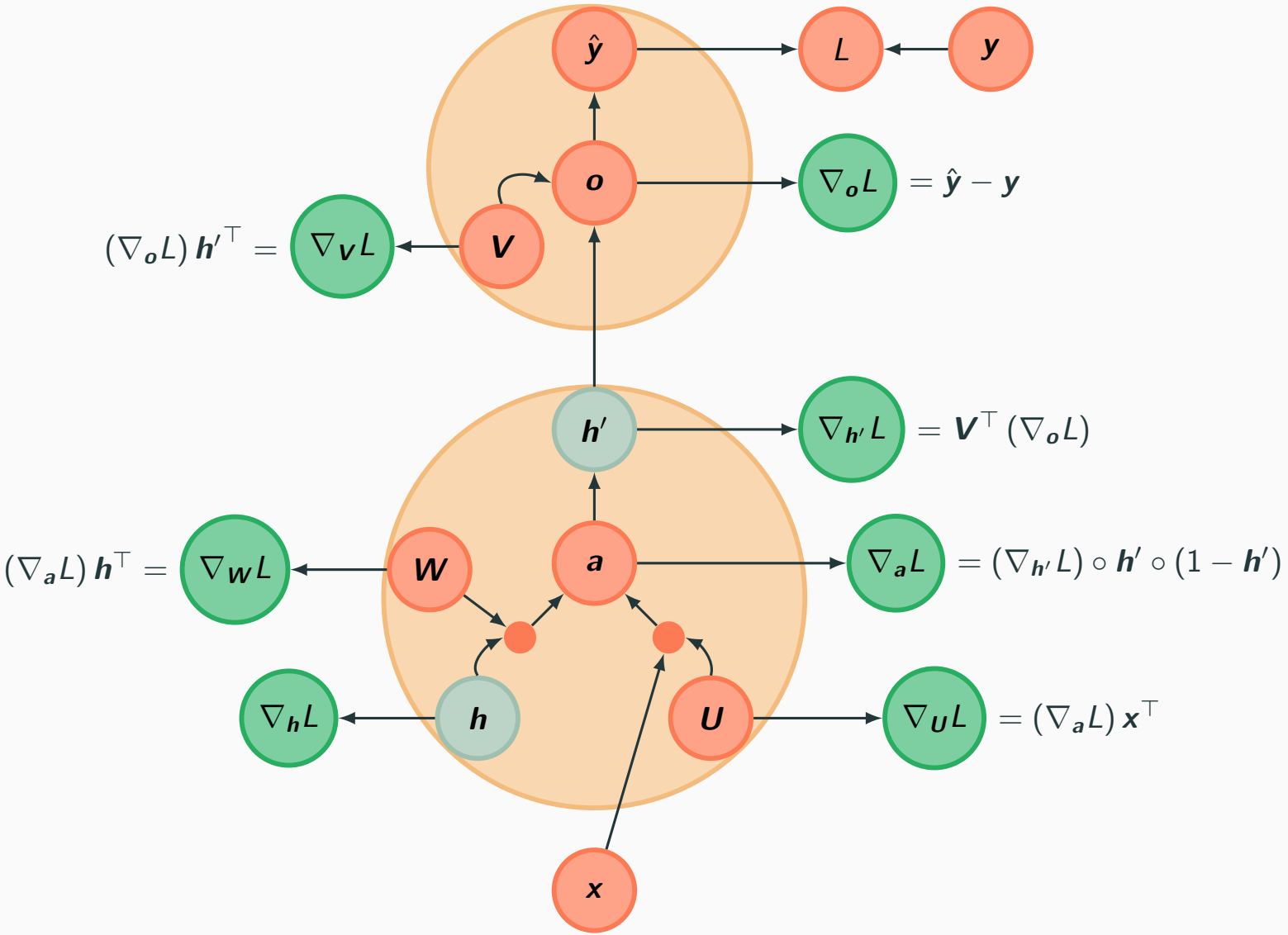

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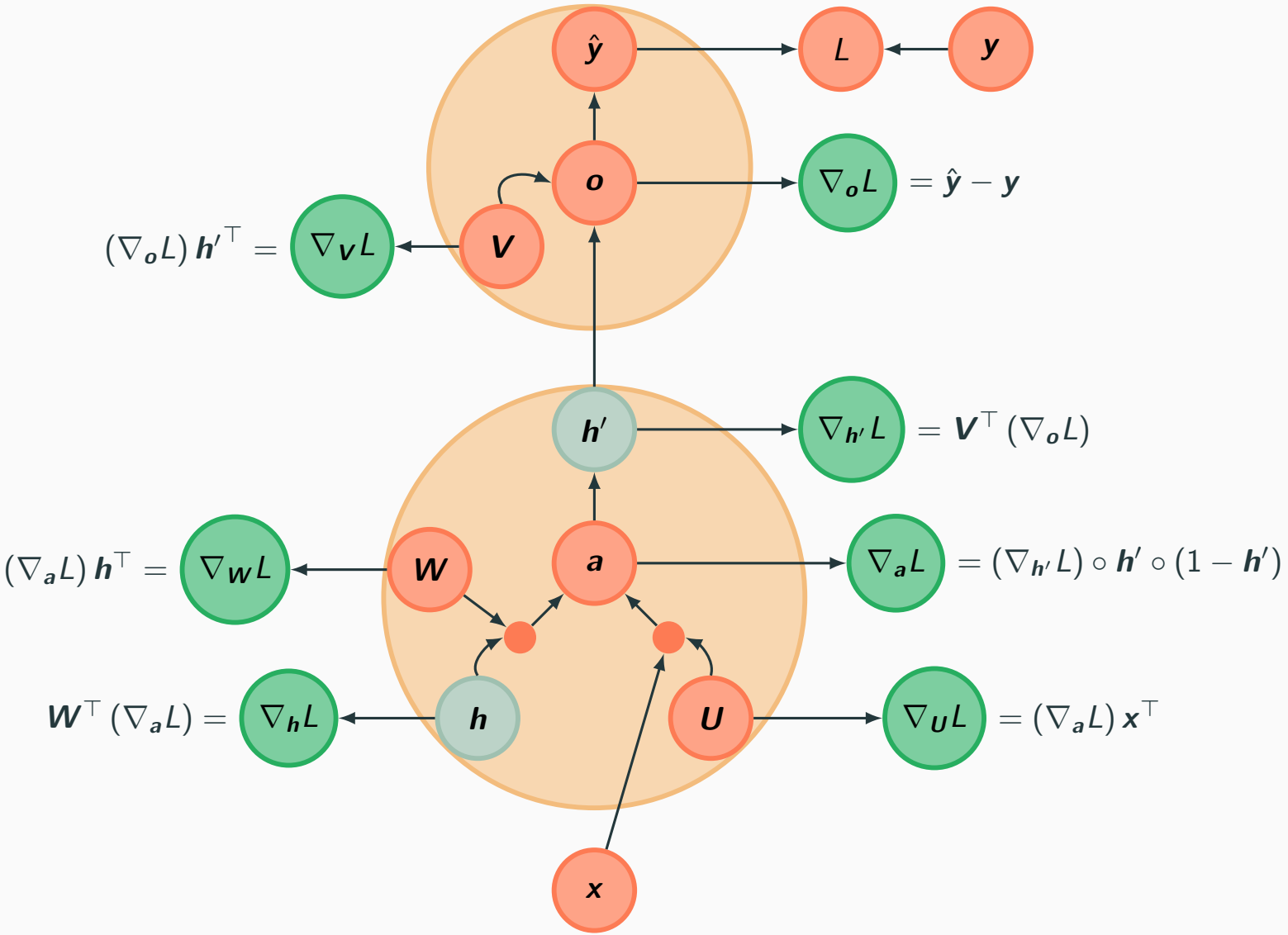

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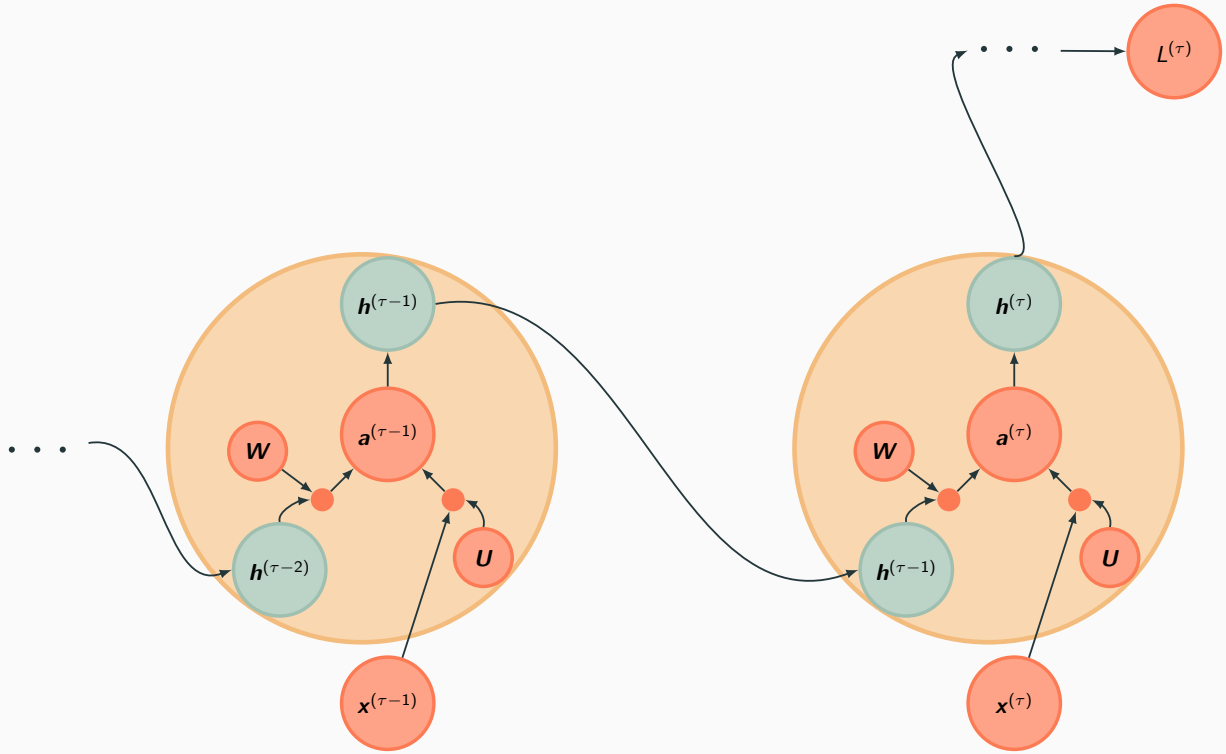

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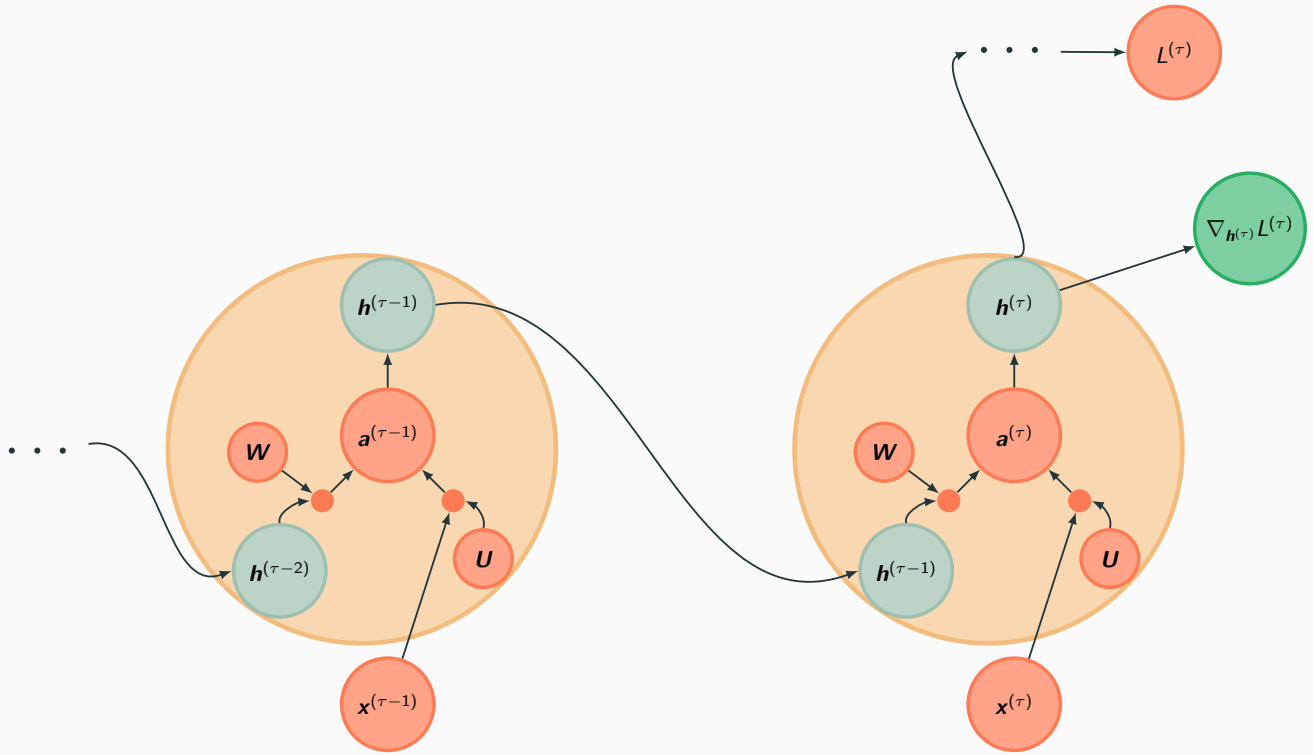

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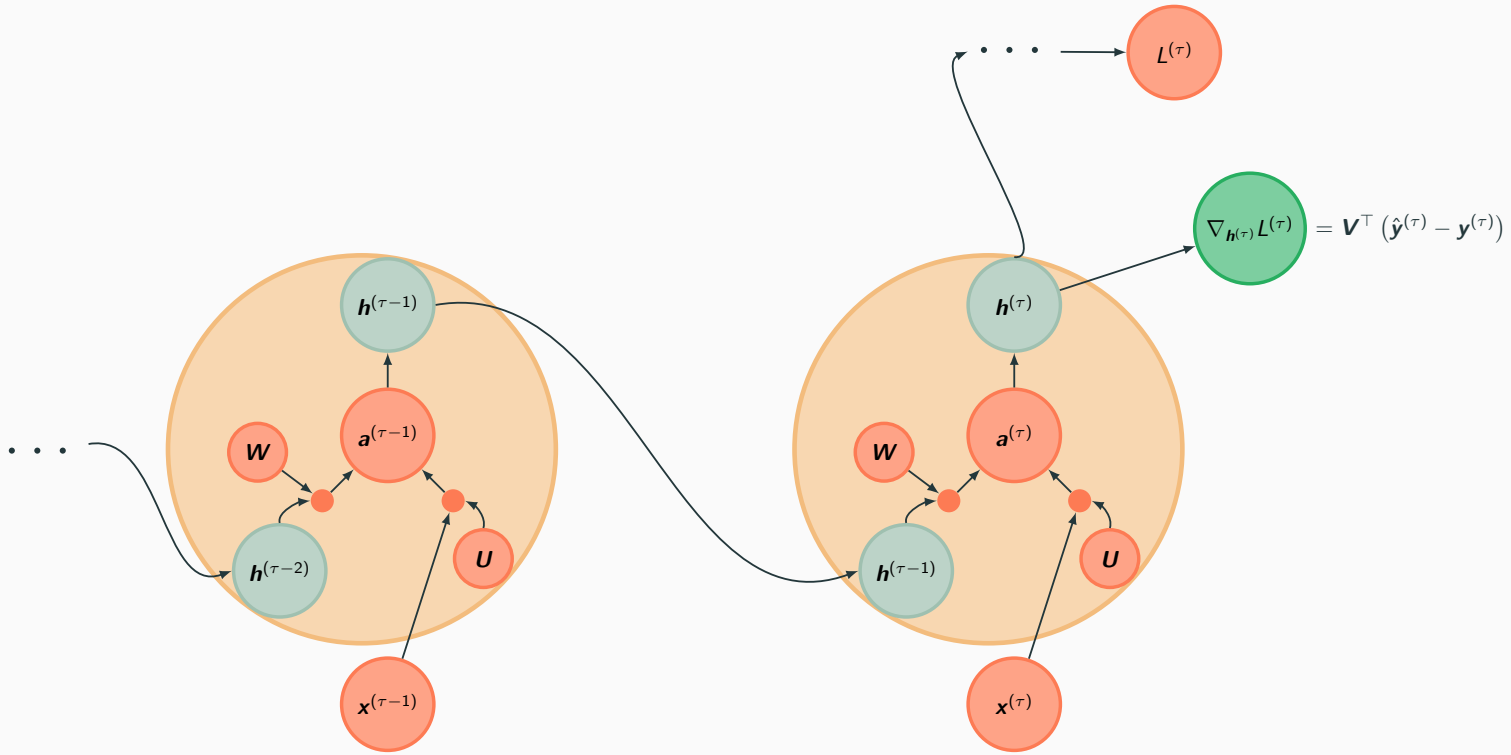

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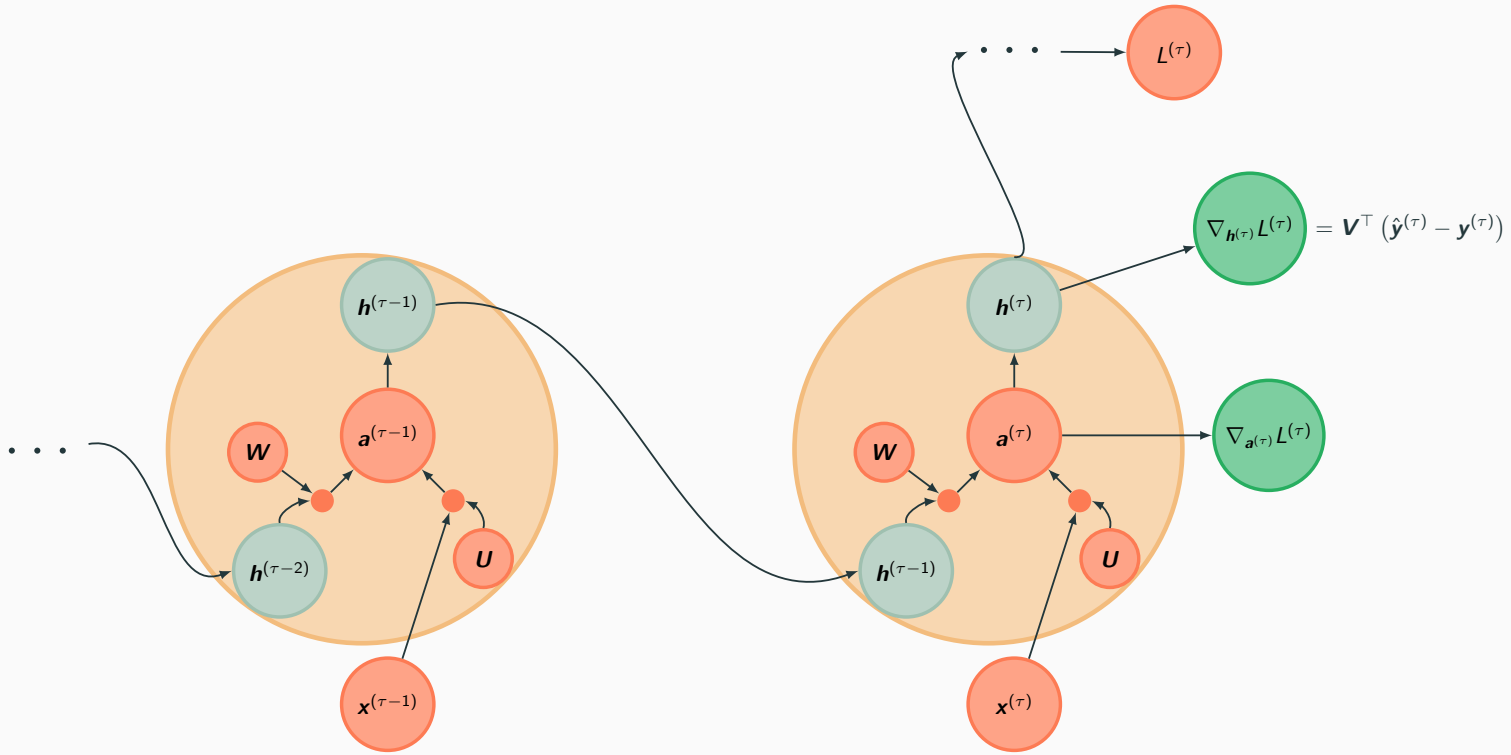

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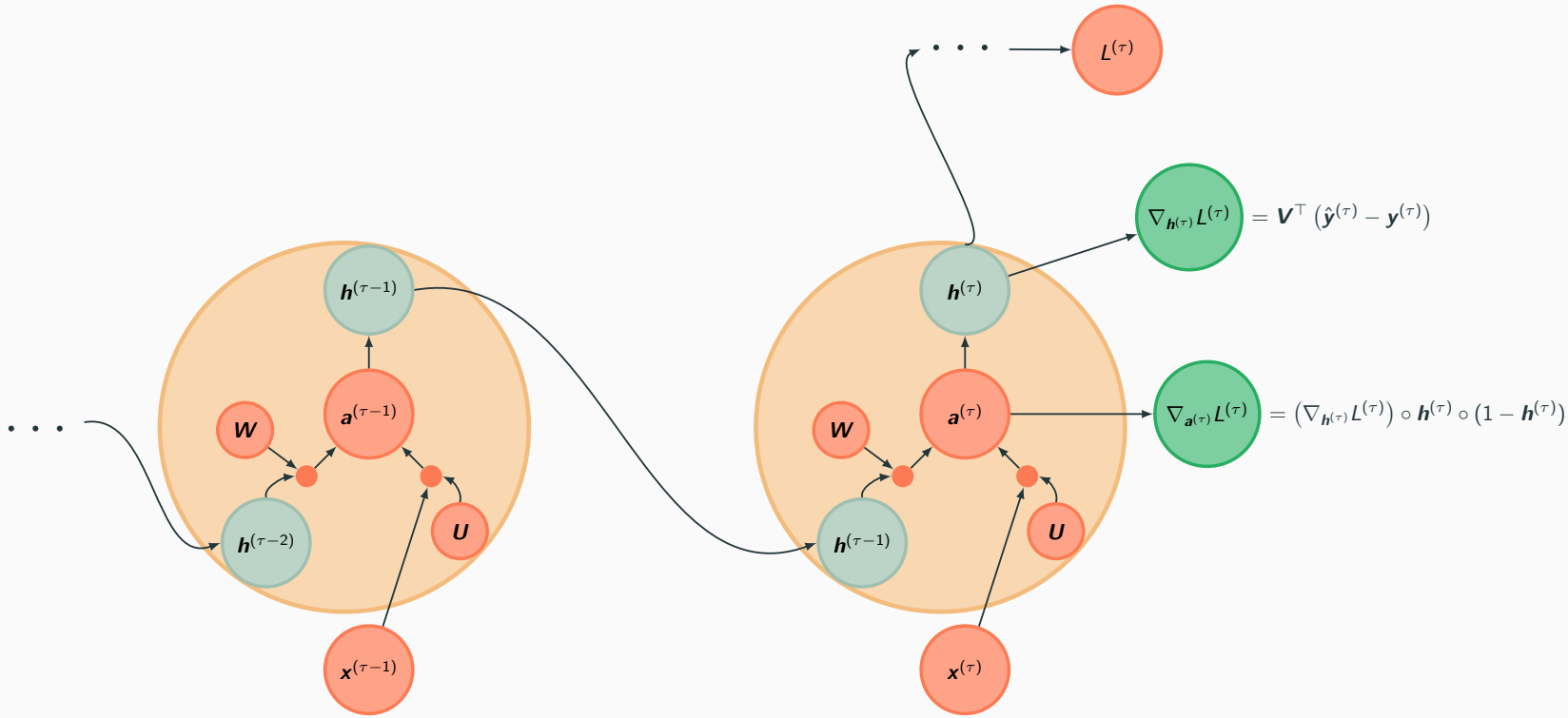

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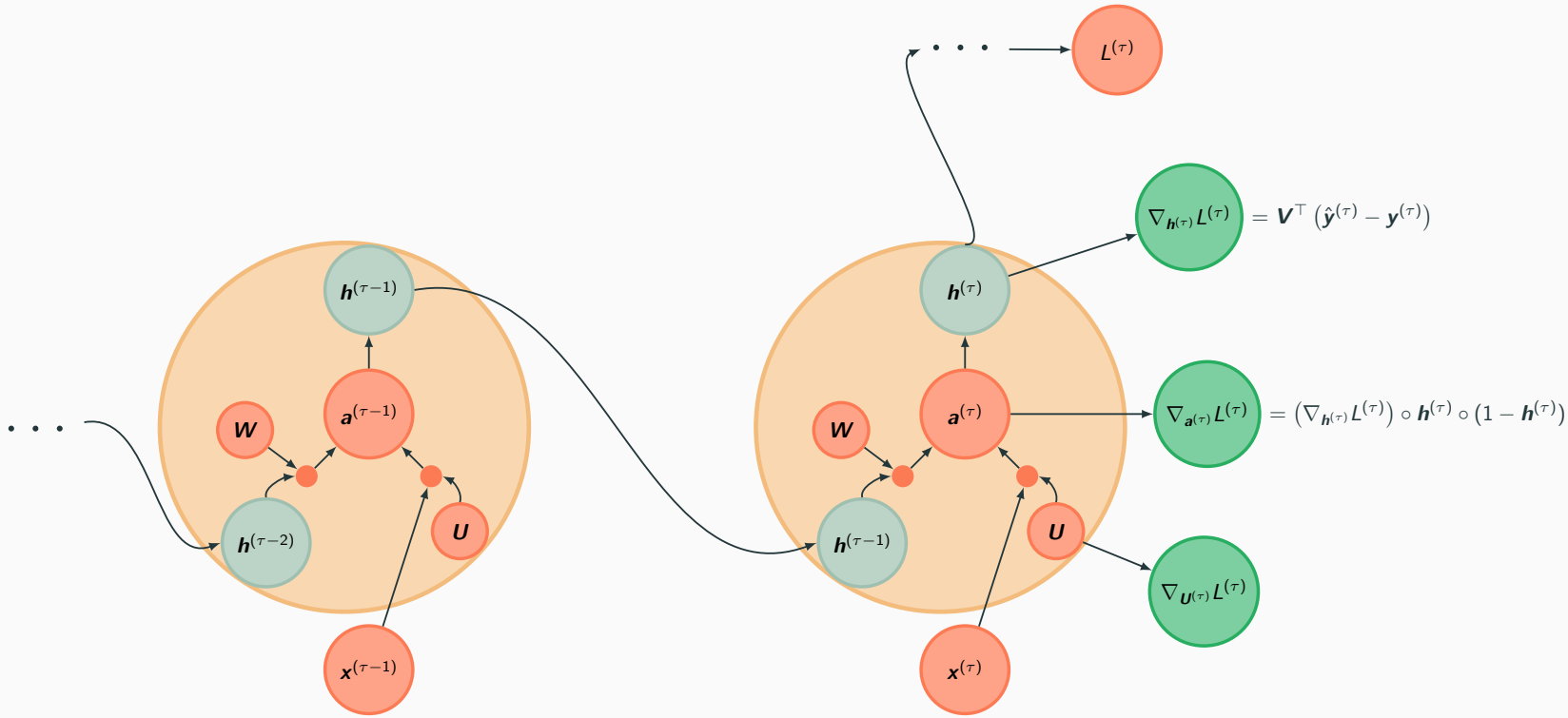

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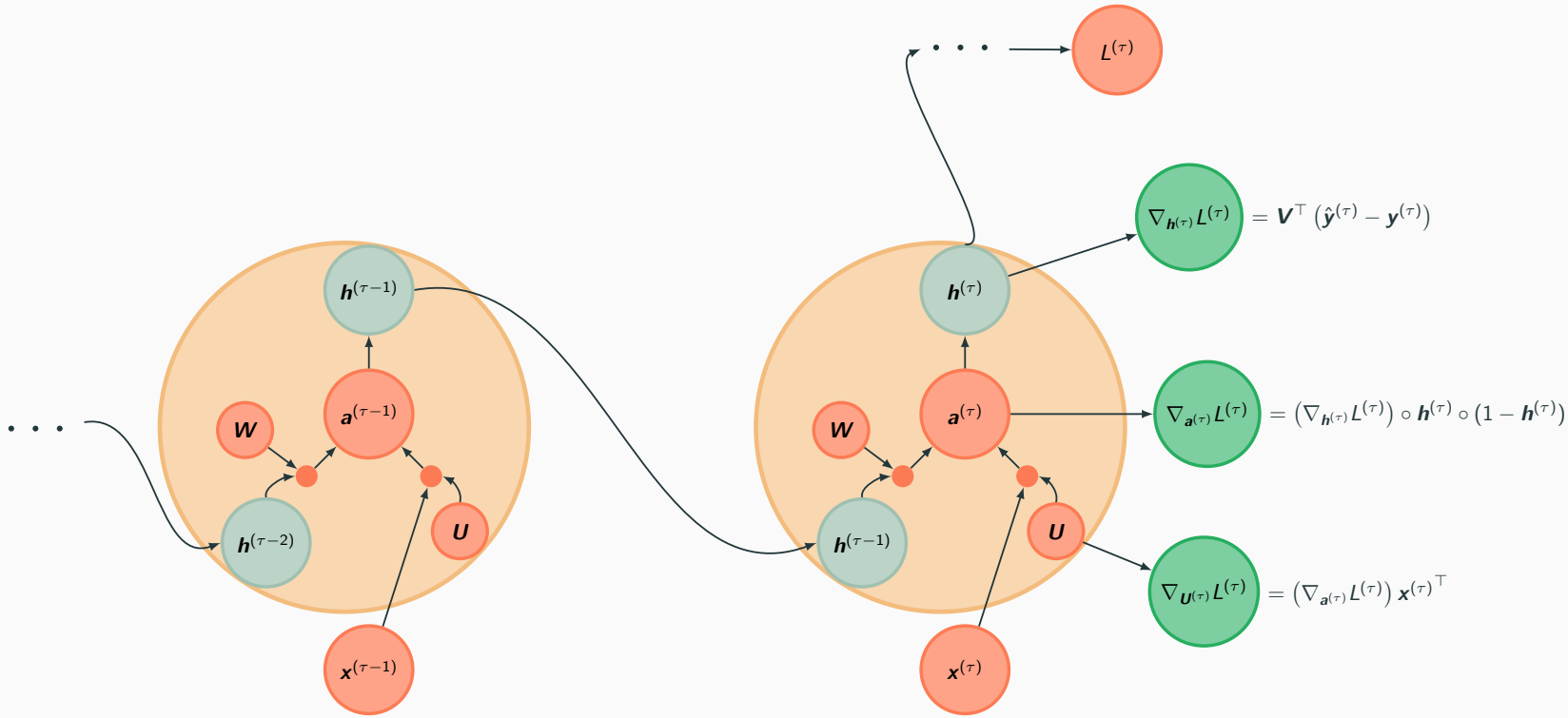

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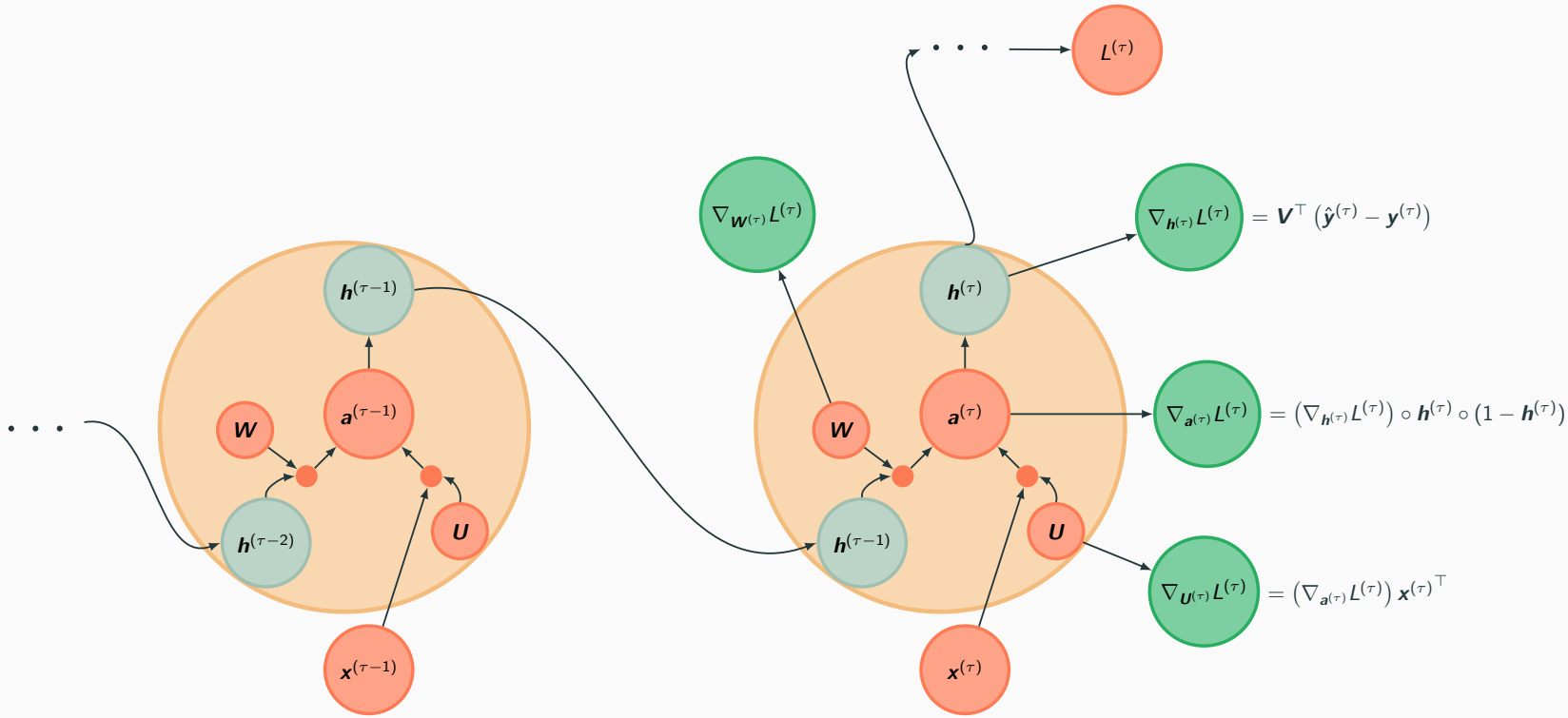

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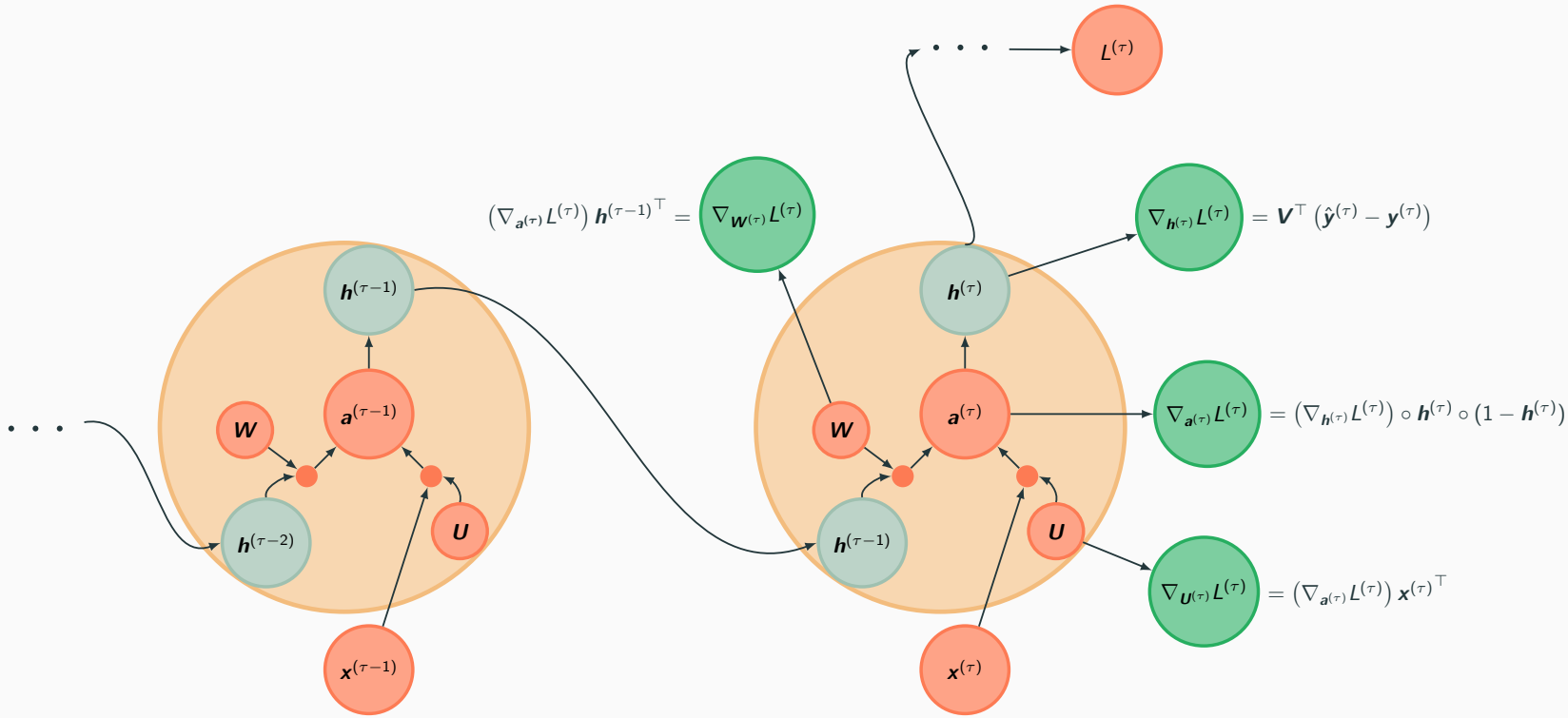

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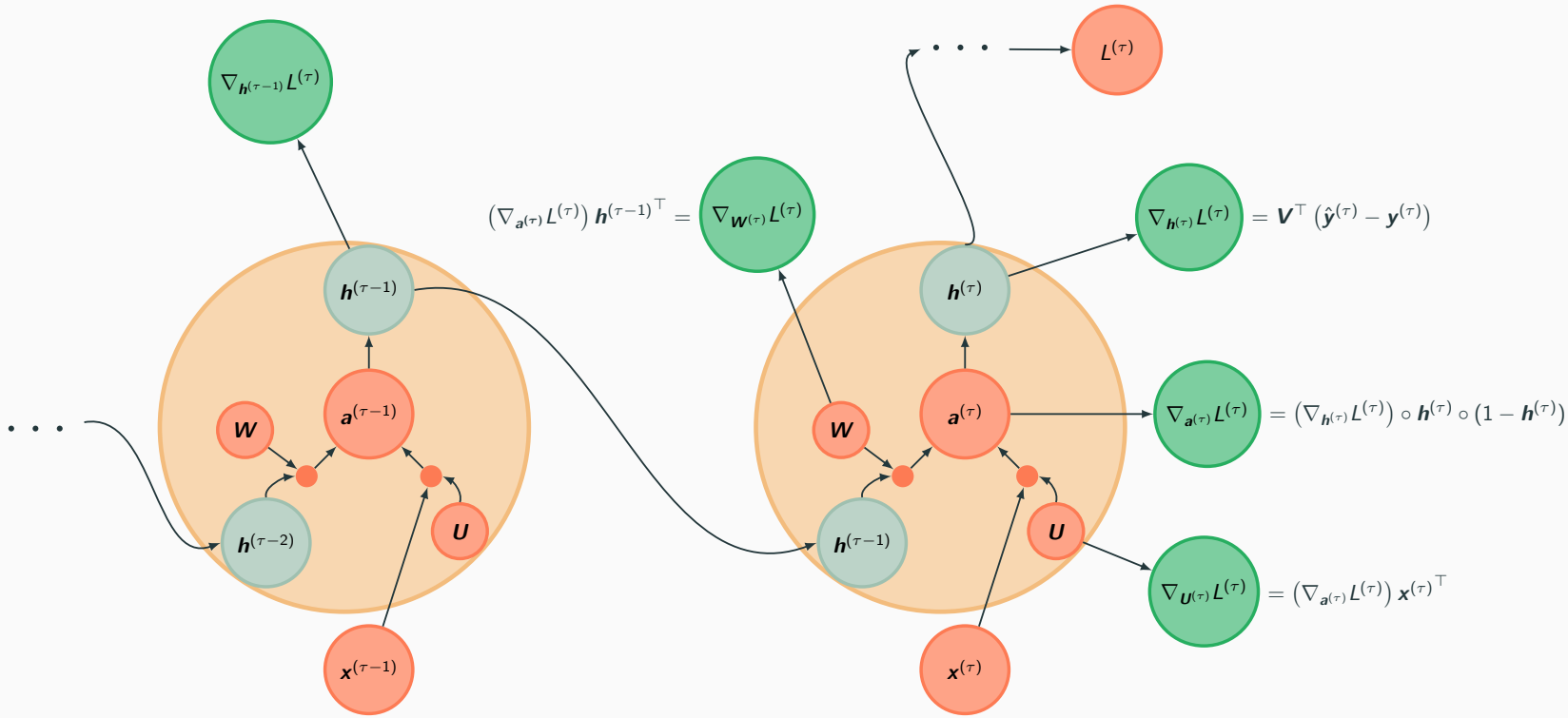

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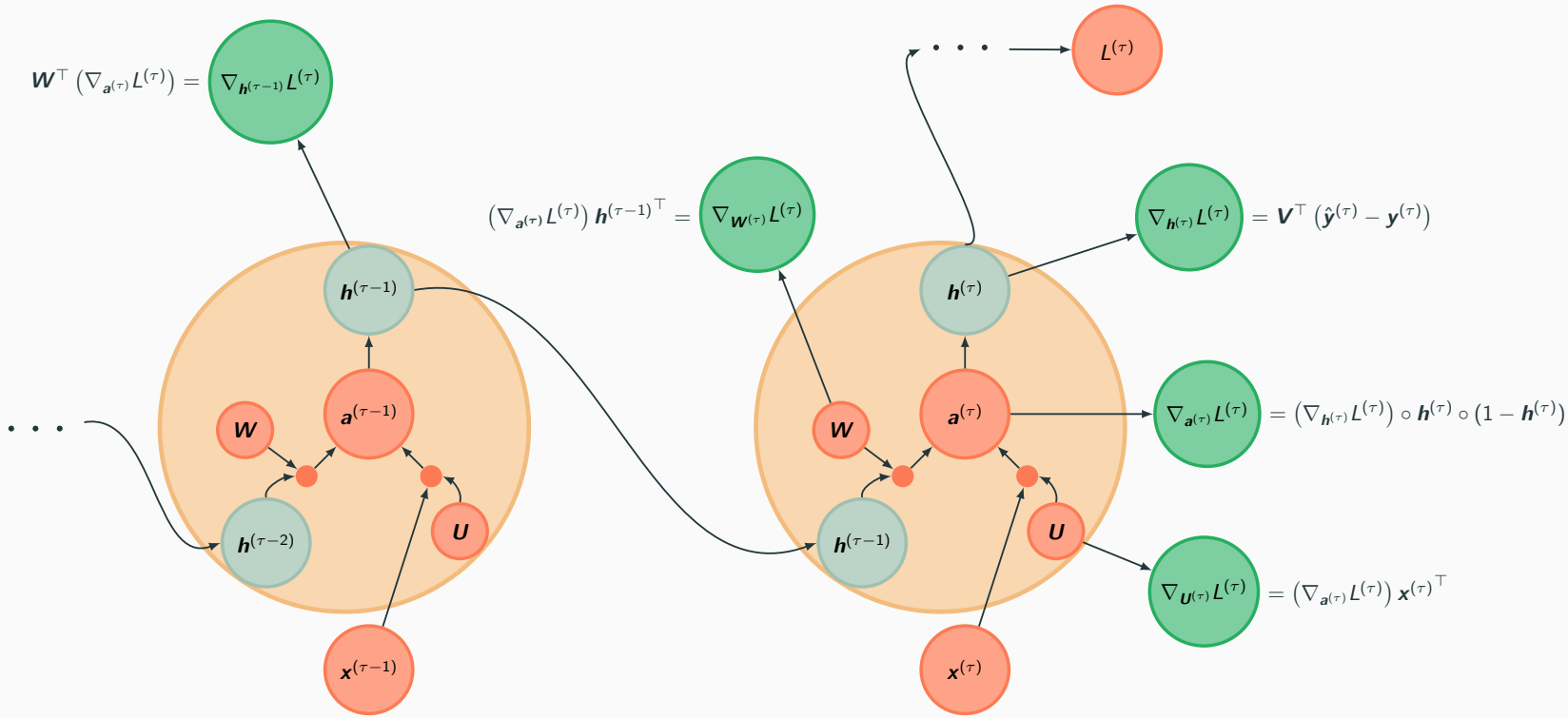

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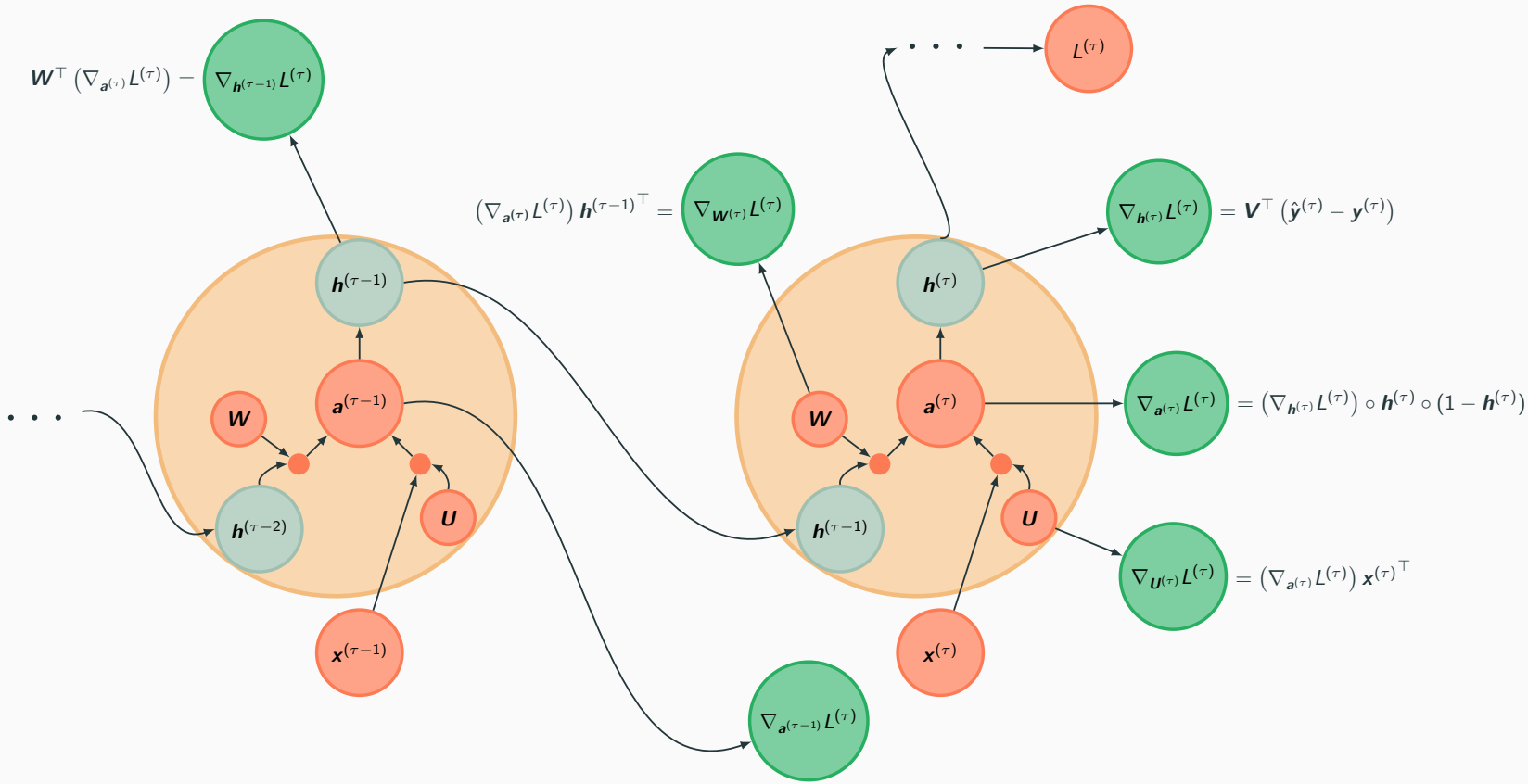

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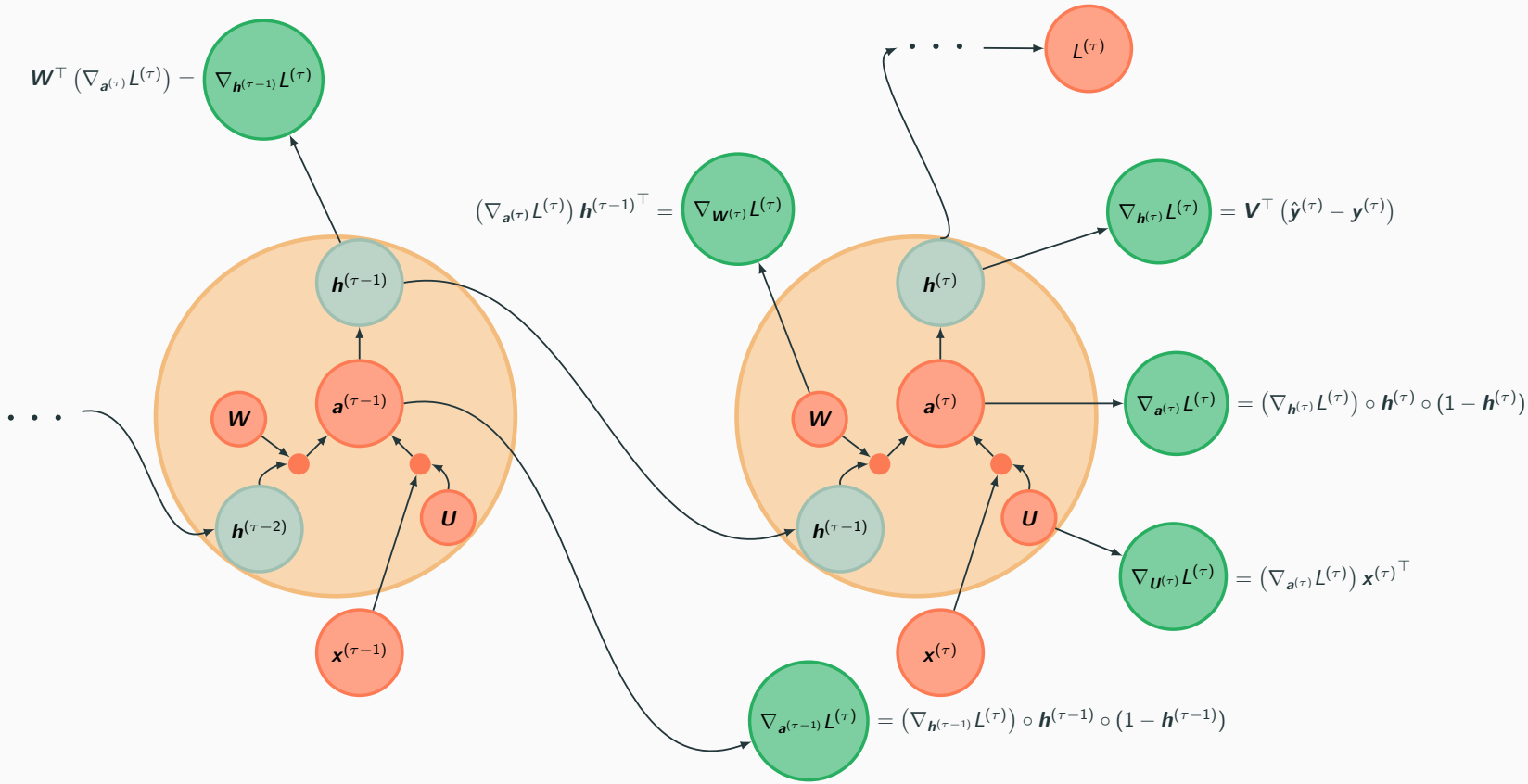

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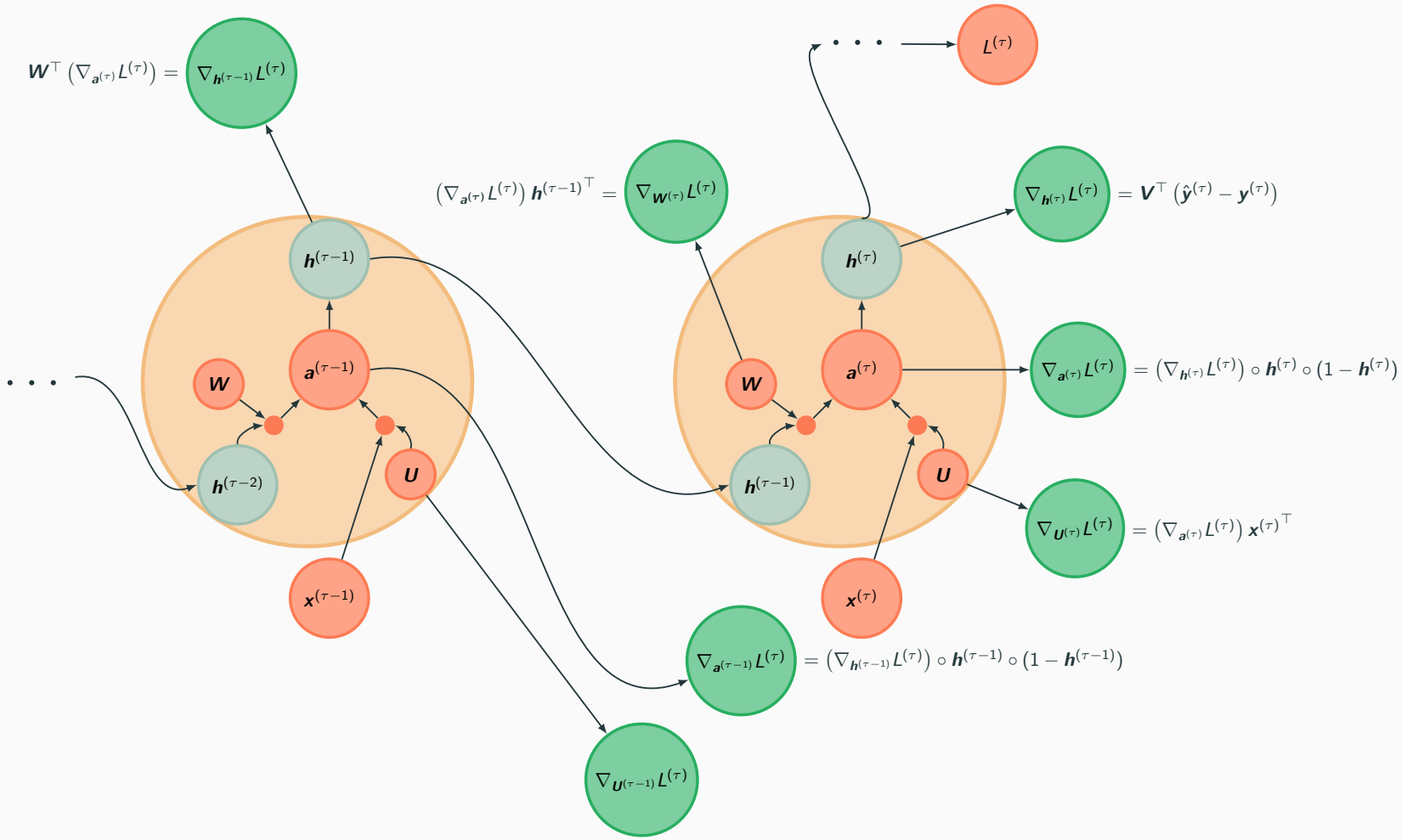

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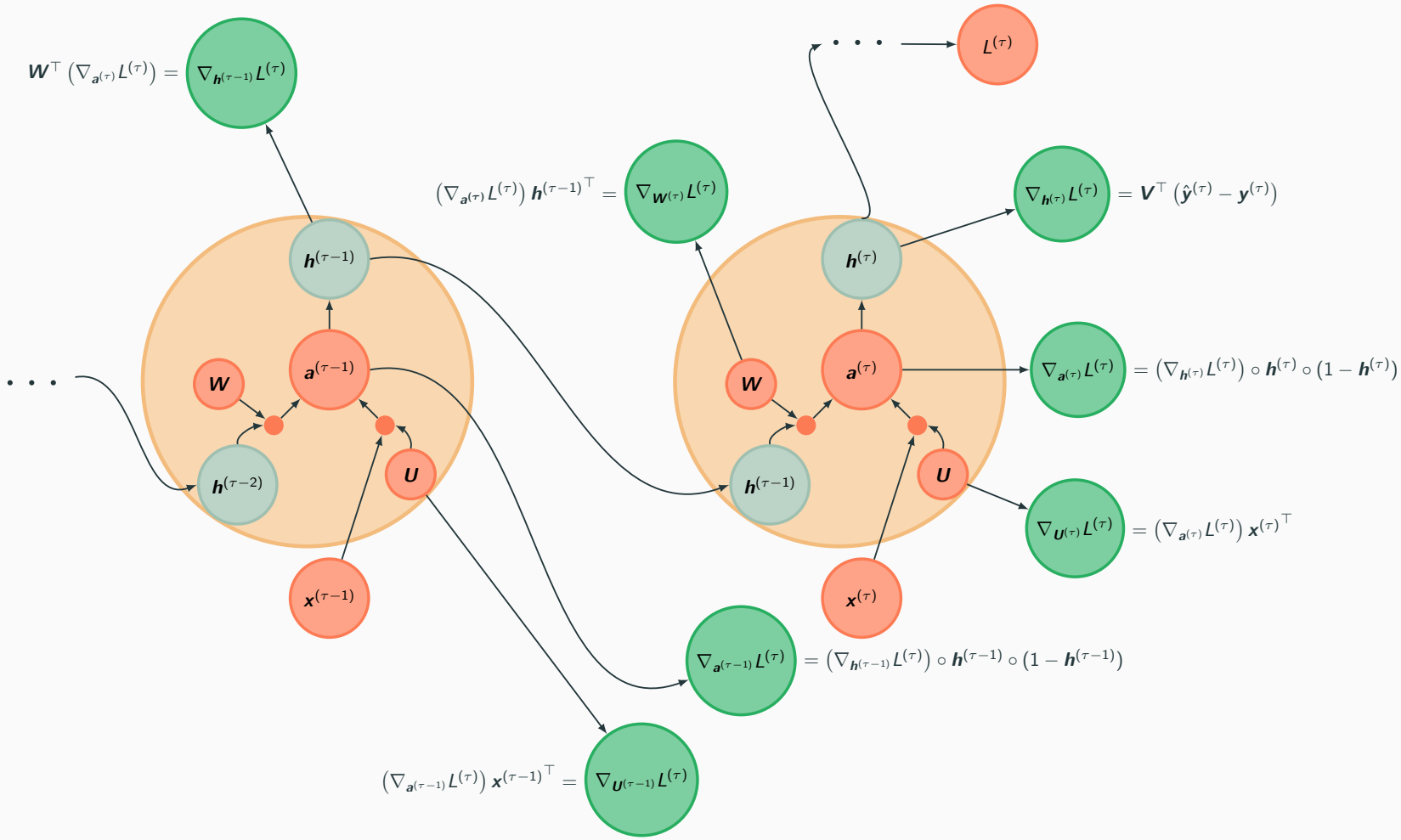

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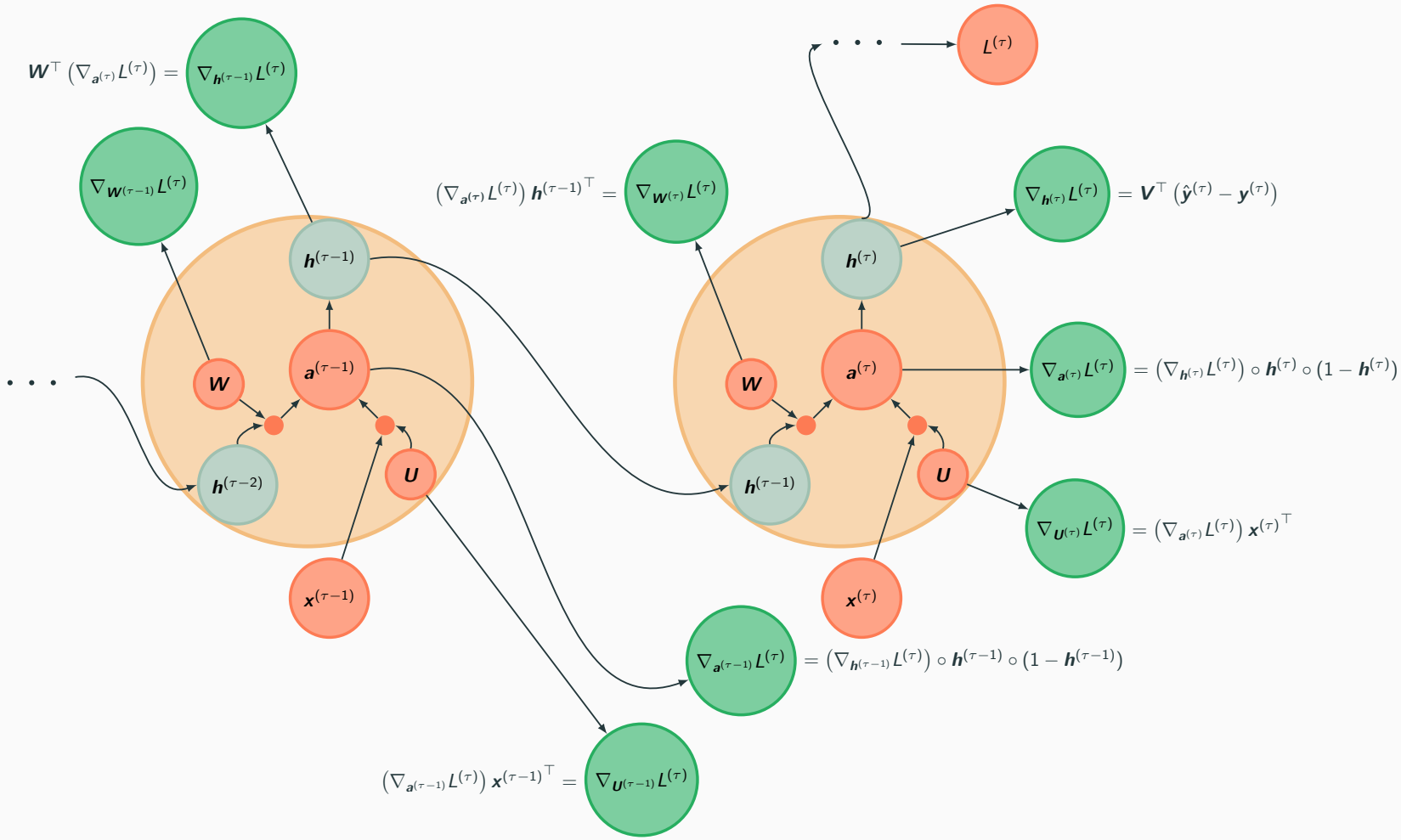

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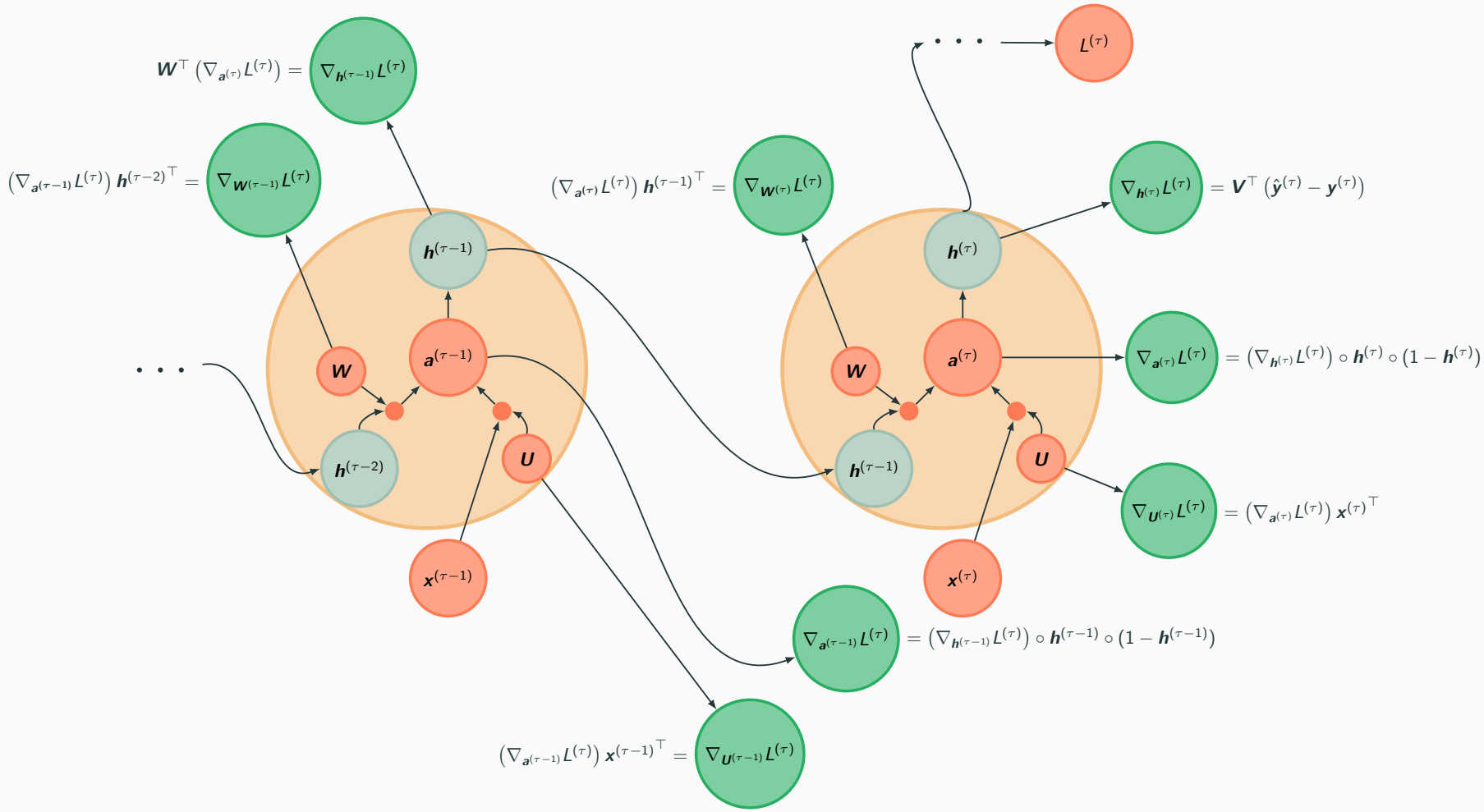

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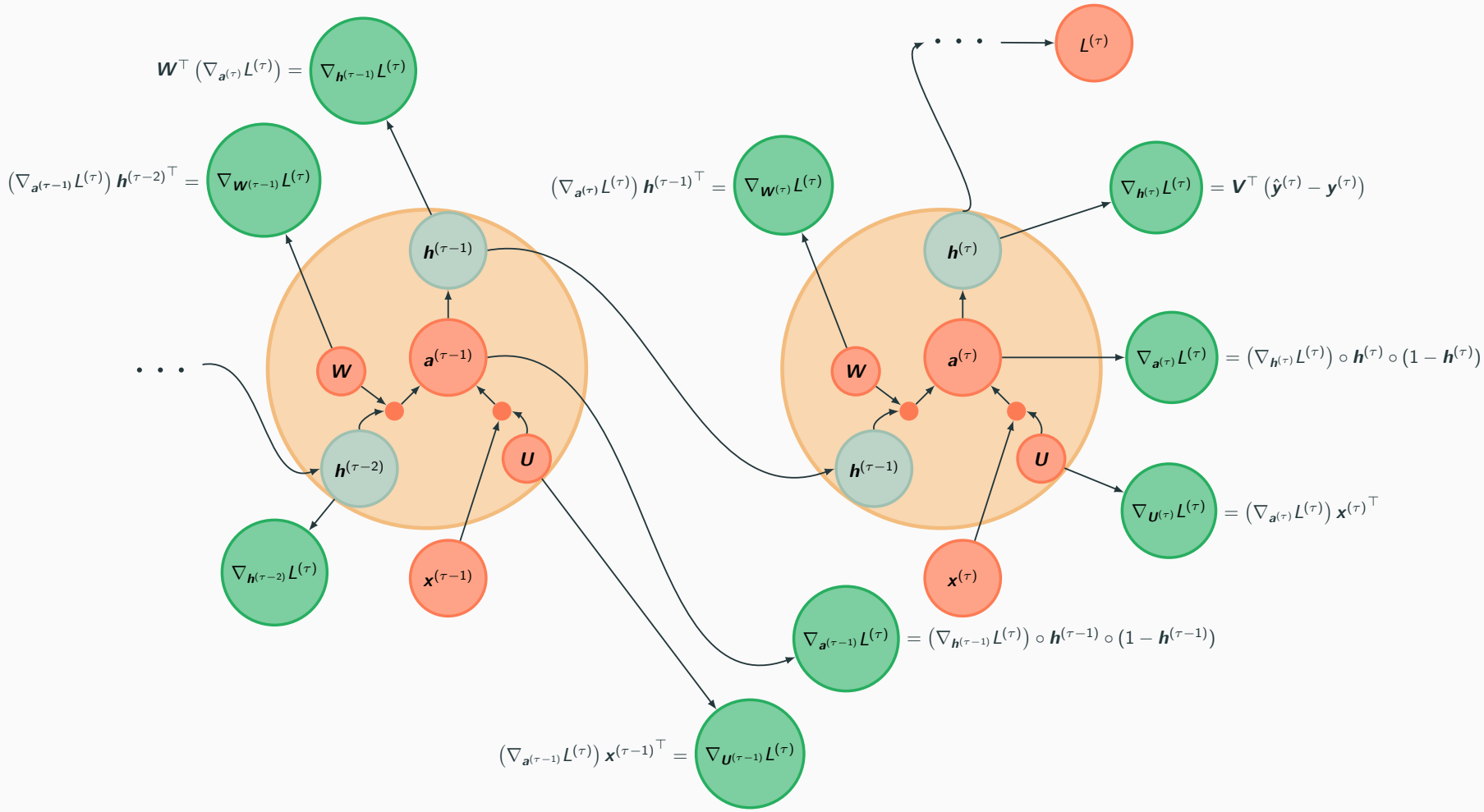

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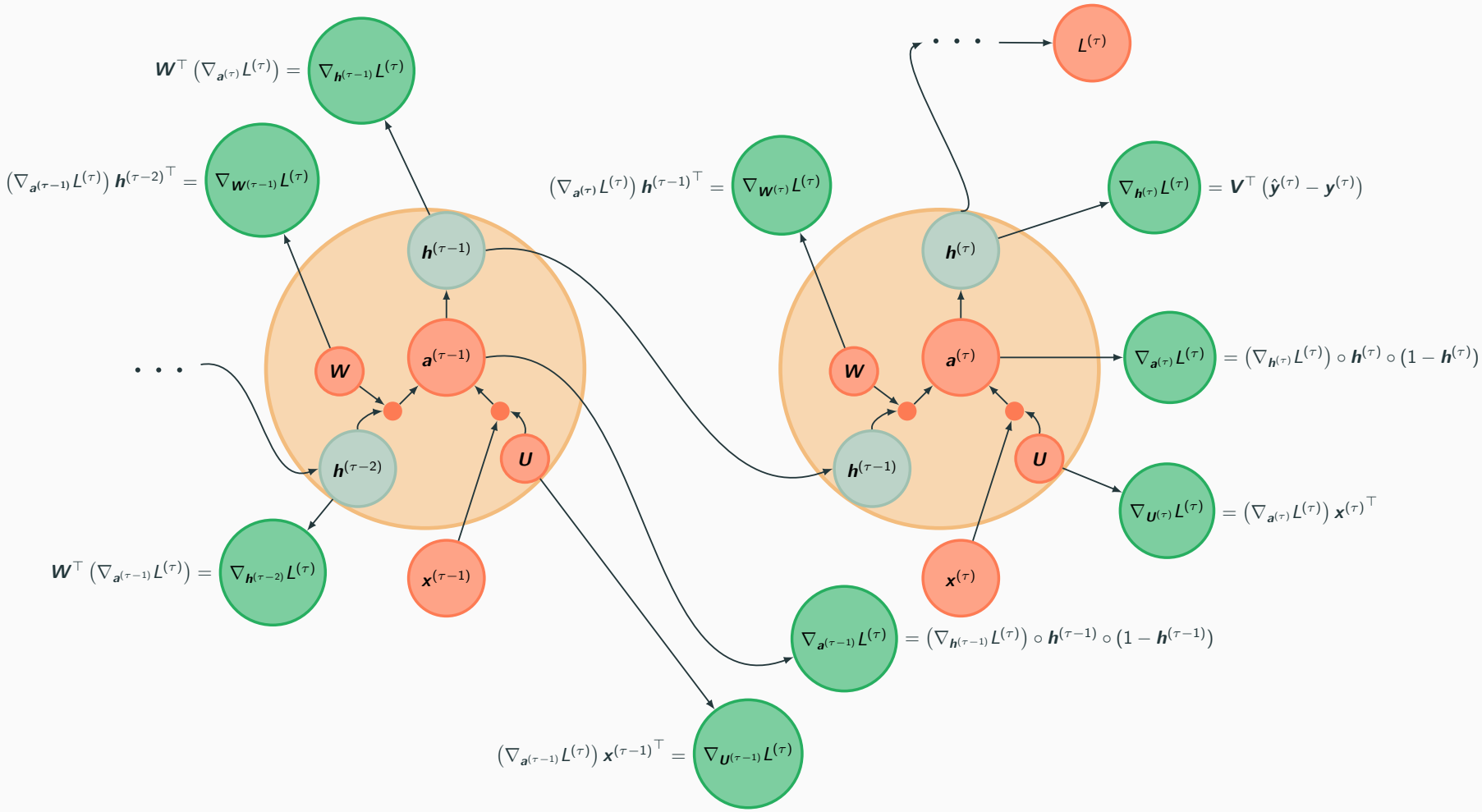
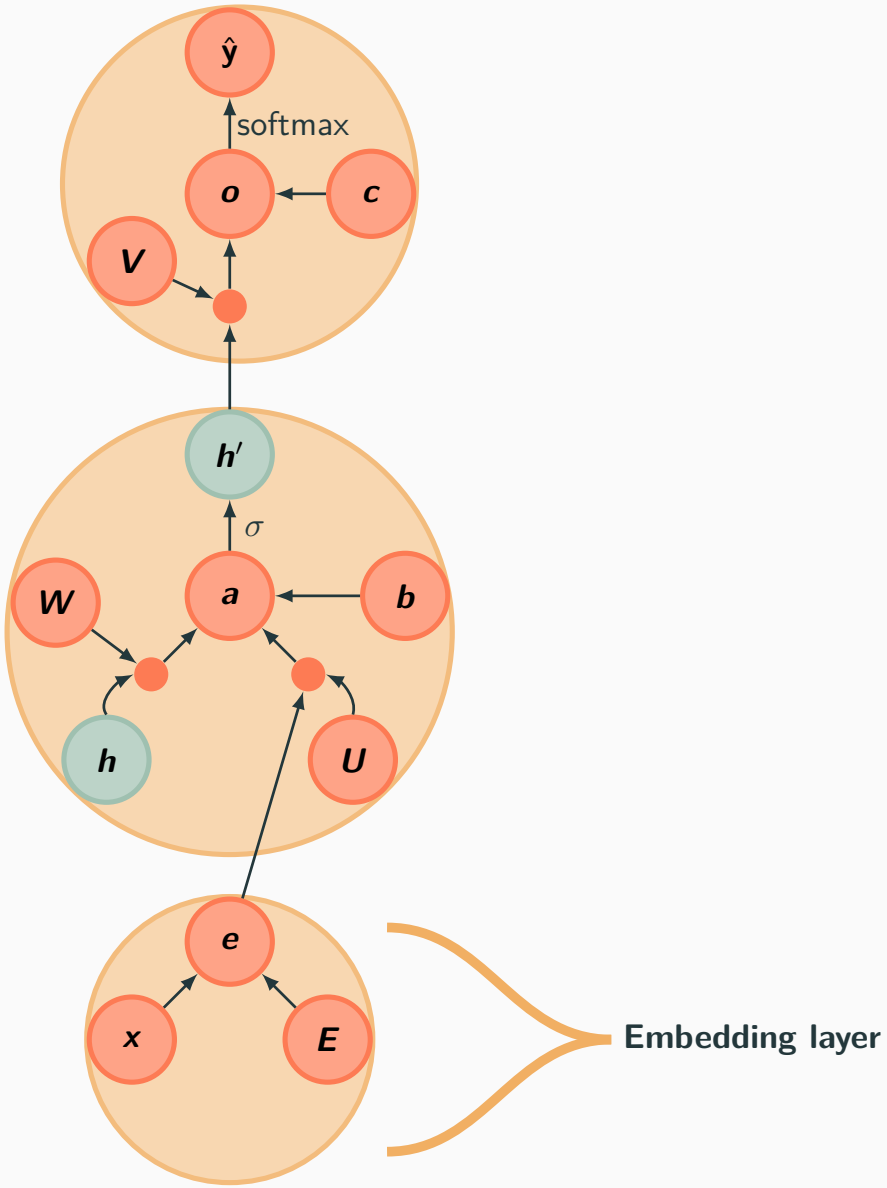


# Language model

# The language model: graph



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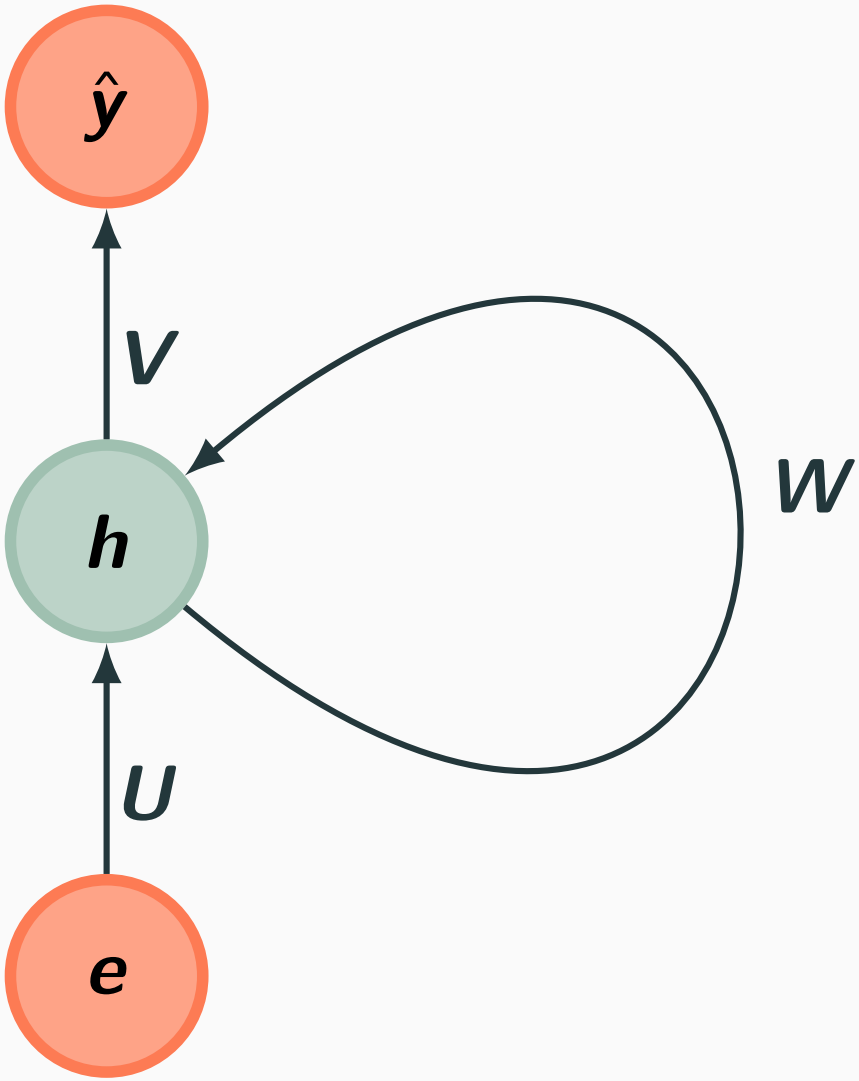
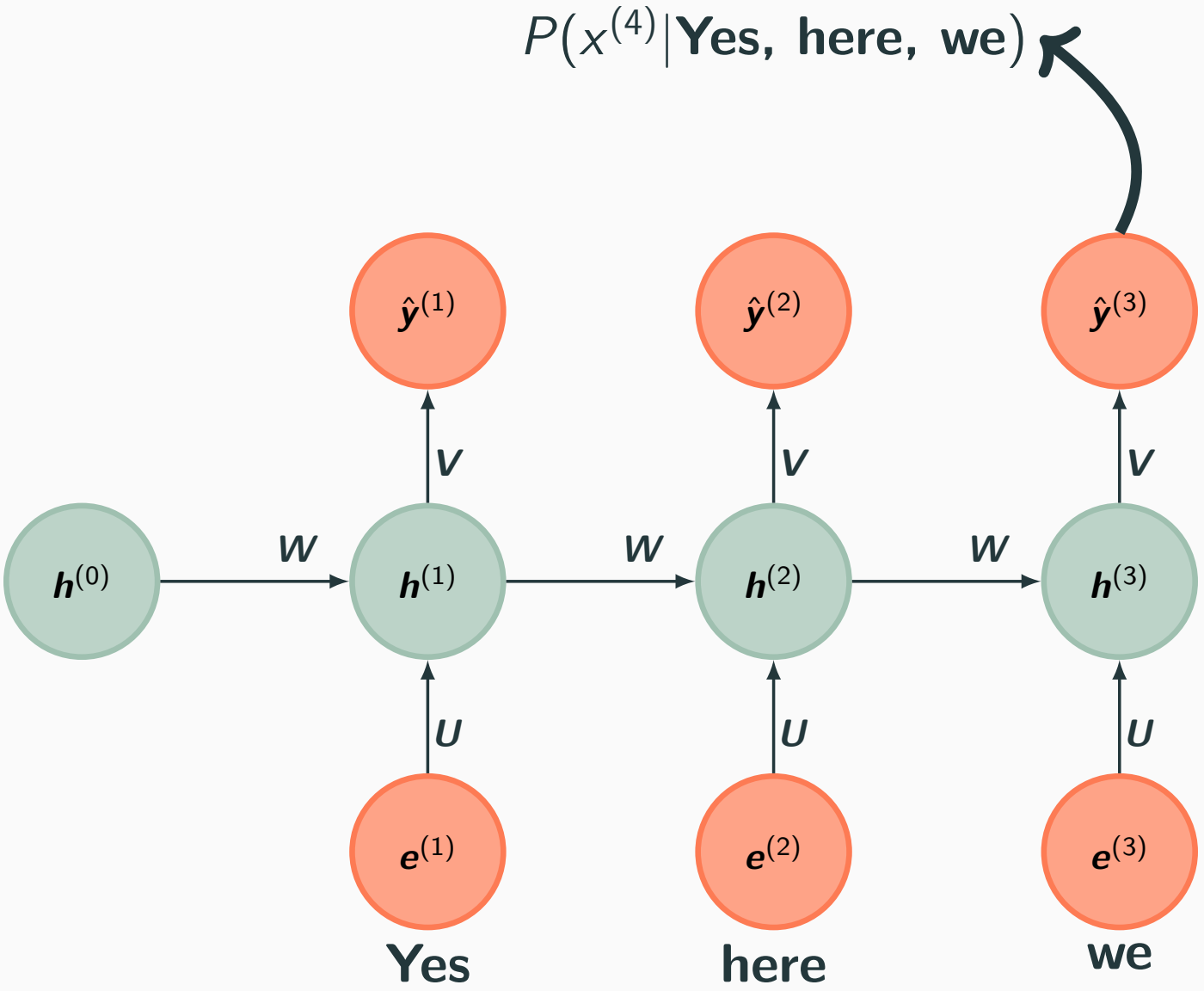


# The Language model: unfolding example



# LSTM

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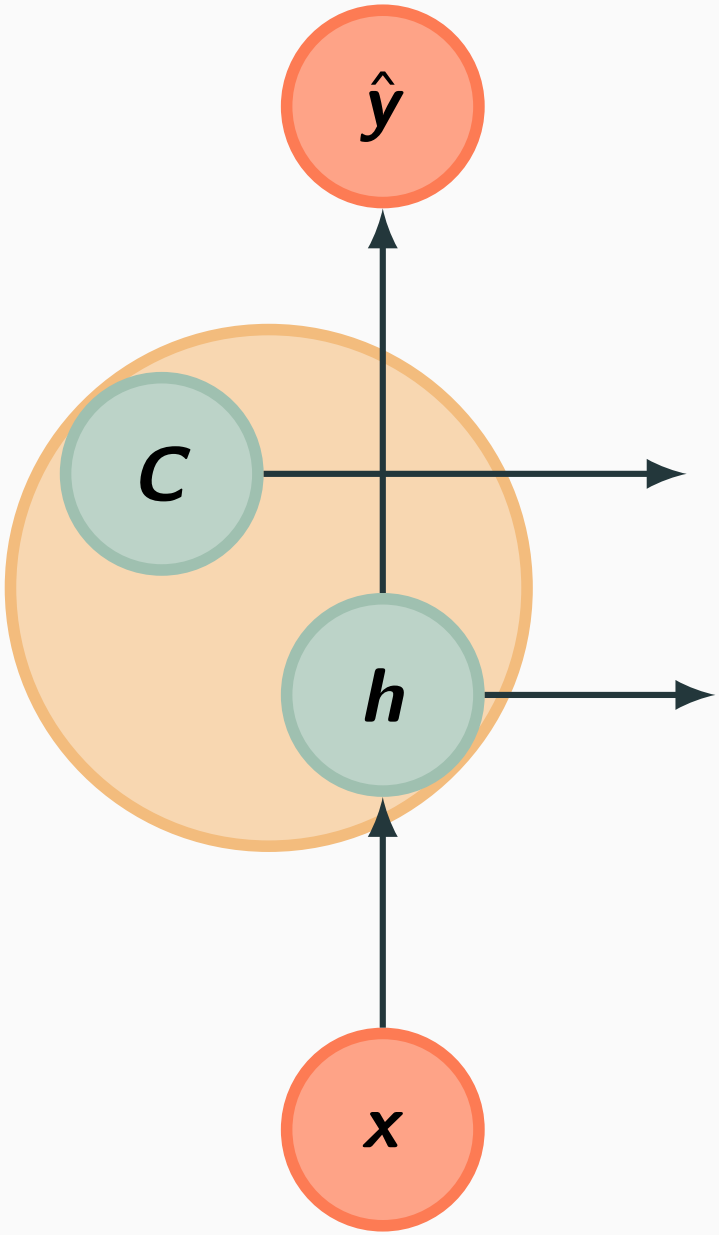
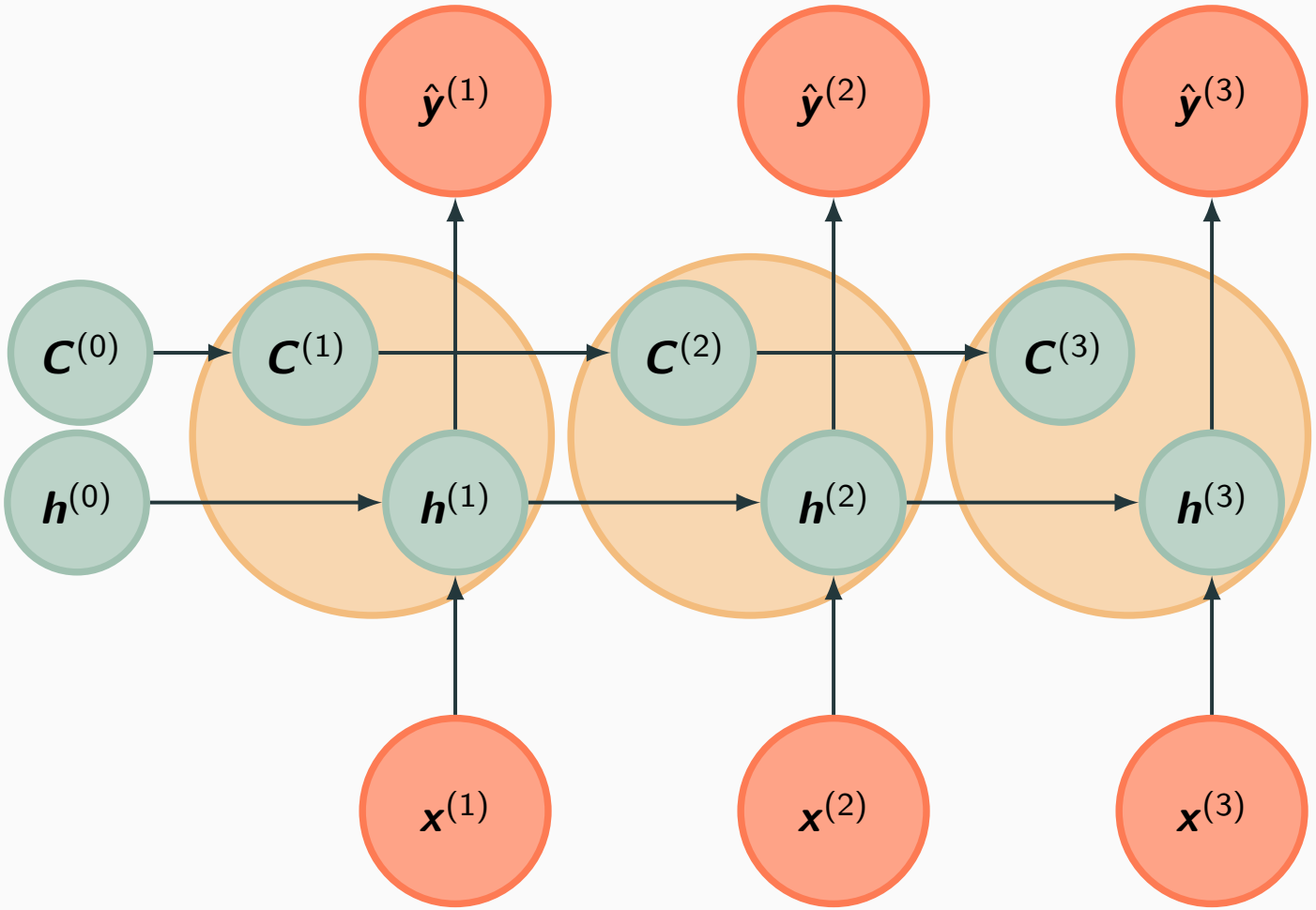
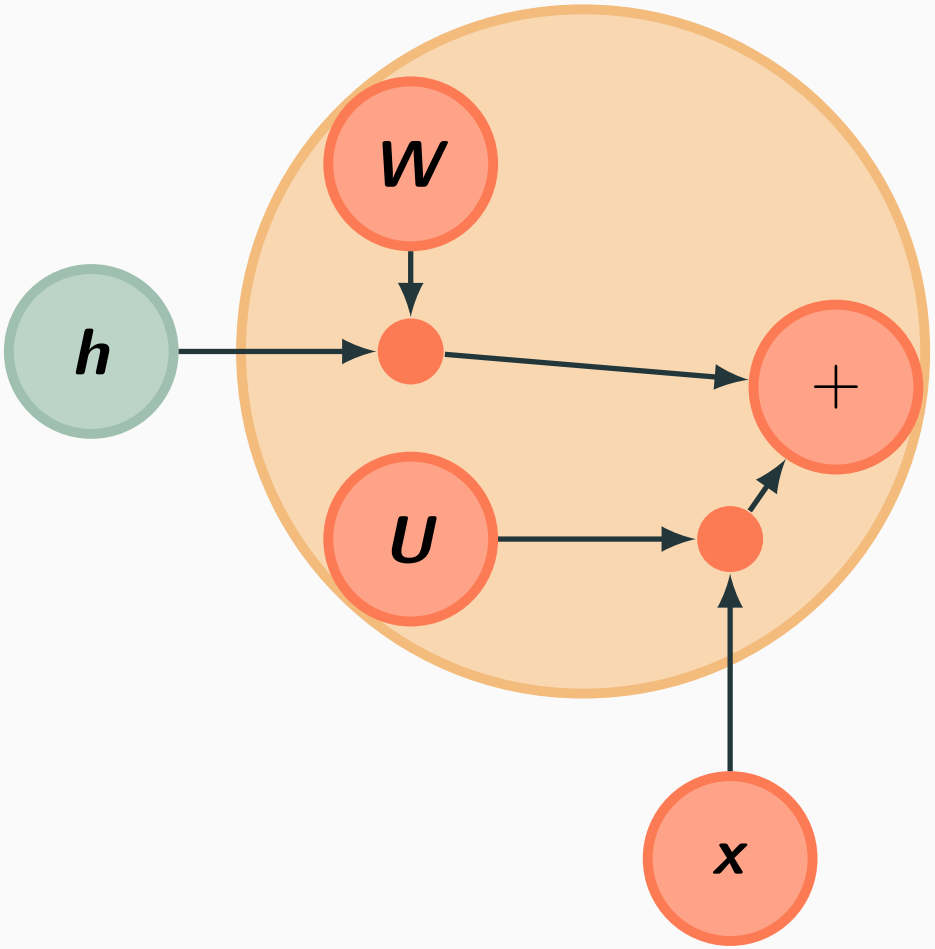


# LSTM: unfolded model

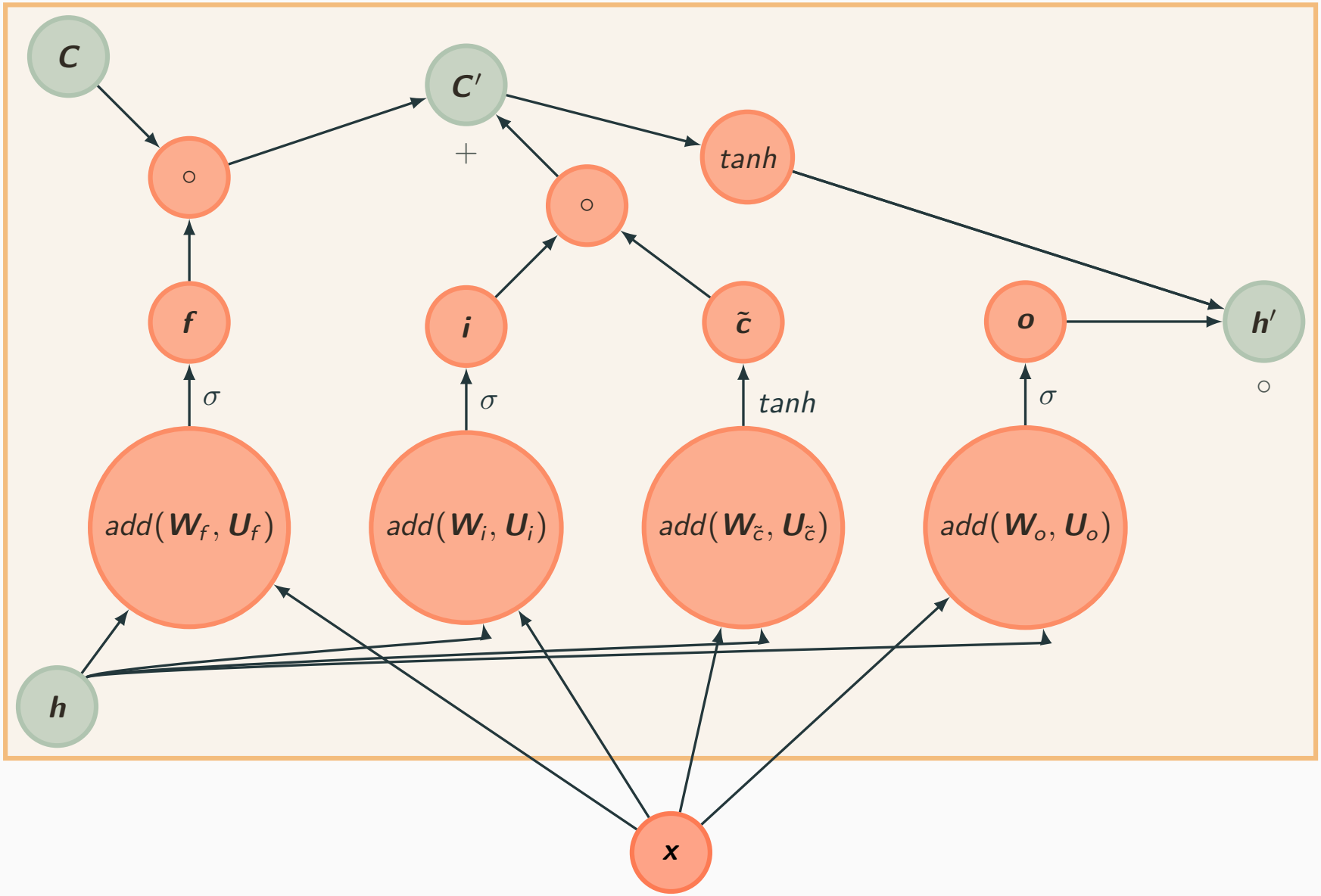


# Simplification




$$add(\boldsymbol{W}, \boldsymbol{U})$$

# LSTM: recurrence



# References i

I. Goodfellow, Y. Bengio, and A. Courville.
***Deep Learning*.**
MIT Press, 2017.