Deep Learning

Self Organizing Maps

Aula 8

Bom dia!

Eu sou Diego Dorgam

Alguma pergunta que você quer fazer?!

http://bit.ly/dl-unb8
https://t.me/DeepLearningUnB
@diegodorgam

Instruções Gerais

- ✓ Traga seu laptop
- ✓ Use Software Livre
- ✓ Não converse por voz
- ✓ Se não entender, pergunte!
- ✓ Se entender, explique!
- ✓ DIVIRTA-SE

O que Aprendemos na aula passada?

1. Intuição
    - Conceito de RNNs
    - Vanishing Gradient Problem
    - LSTMs and Variations
2. Prática
    - Building RNN

O que Vamos Aprender HOJE?

1. Intuição
    - Conceito de SOMs
    - Como SOMs aprendem
2. Prática
    - Building SOMs

O que são SOMs

Self Organizing Maps

Onde Estamos

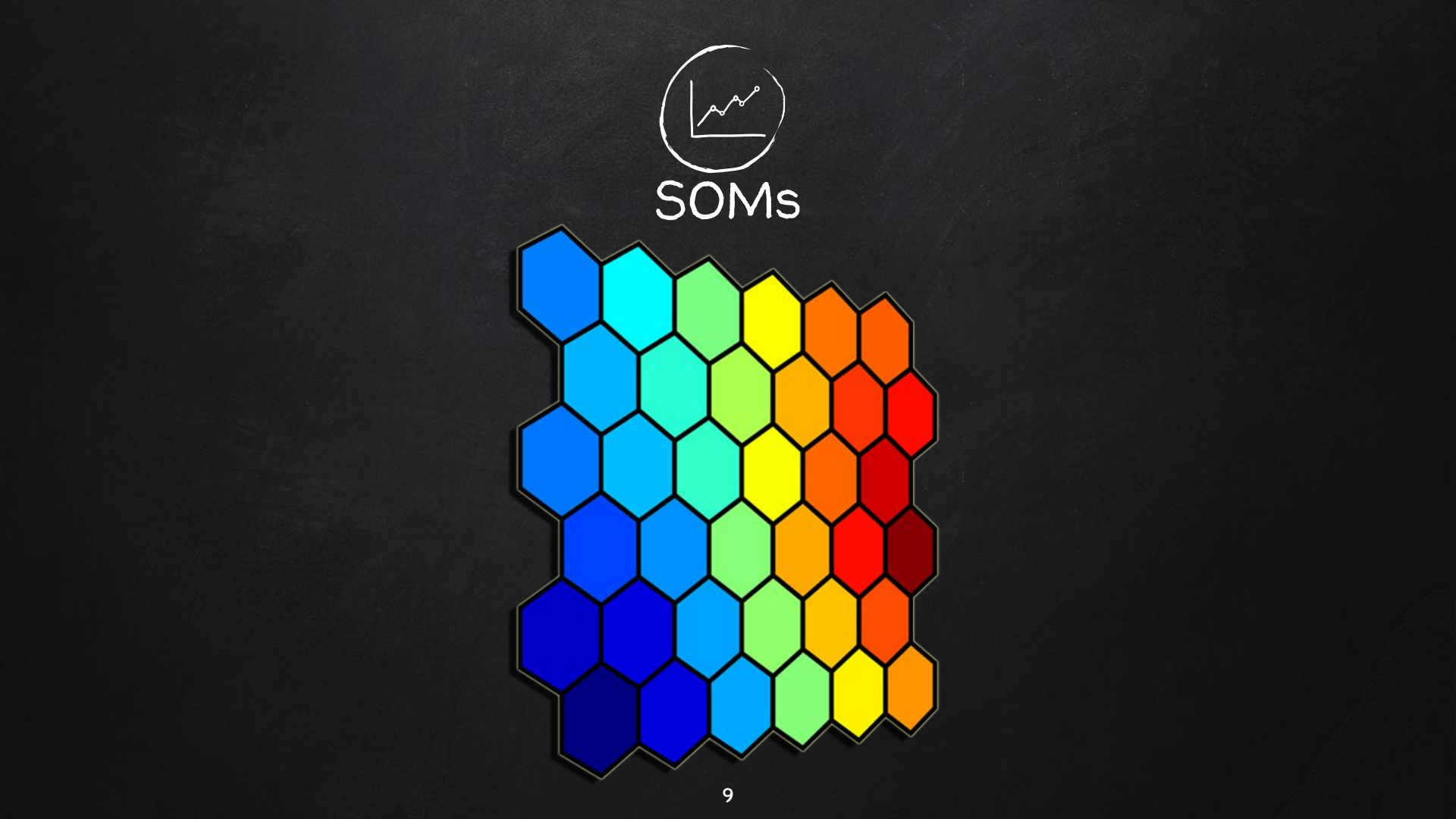
Supervisionado	~~Artificial Neural Networks~~	~~Regression & Classification~~
	~~Convolutional Neural Networks~~	~~Computer Vision~~
	~~Recurrent Neural Networks~~	~~Time Series Analysis~~
Não Supervisionado	Self-Organizing Maps	Feature Detection
	Deep Boltzmann Machines	Recommendation Systems
	AutoEncoders	Recommendation Systems

Tuevo Kohonen

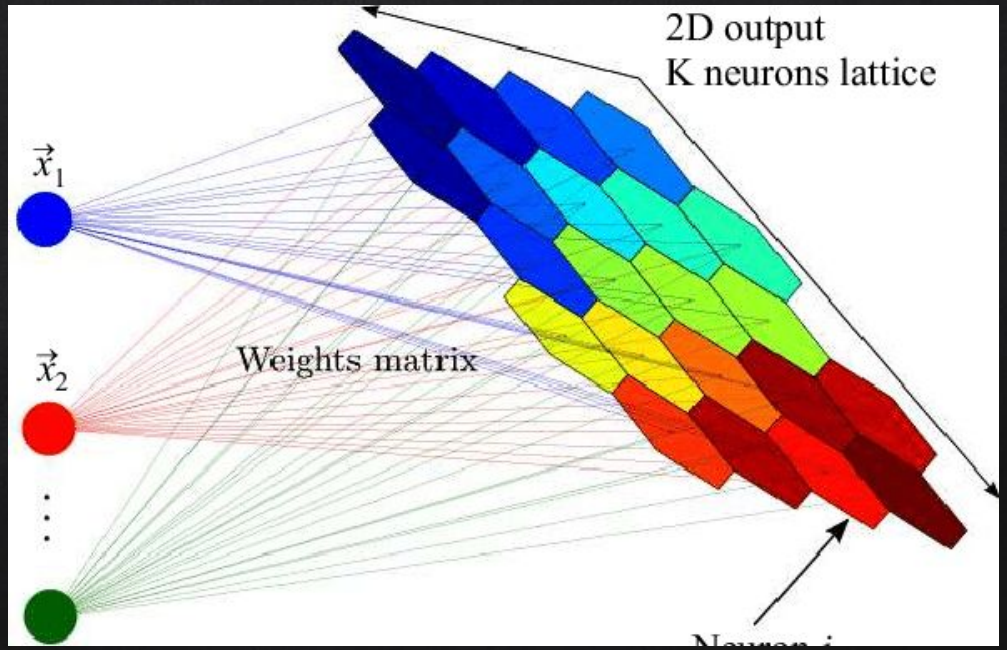
1990 Tuevo Kohonen

The Self Organizing Map

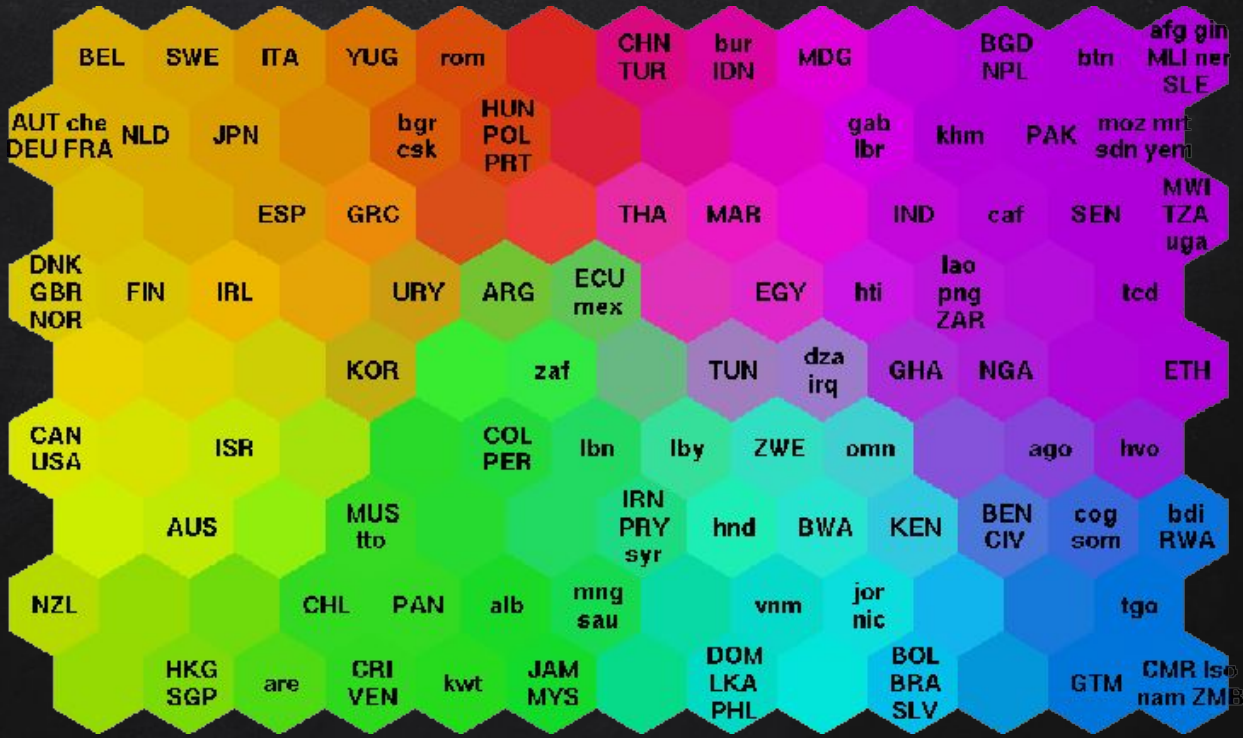
https://sci2s.ugr.es/keel/pdf/algorithm/articulo/1990-Kohonen-PIEEE.pdf


SOMs

SOMs

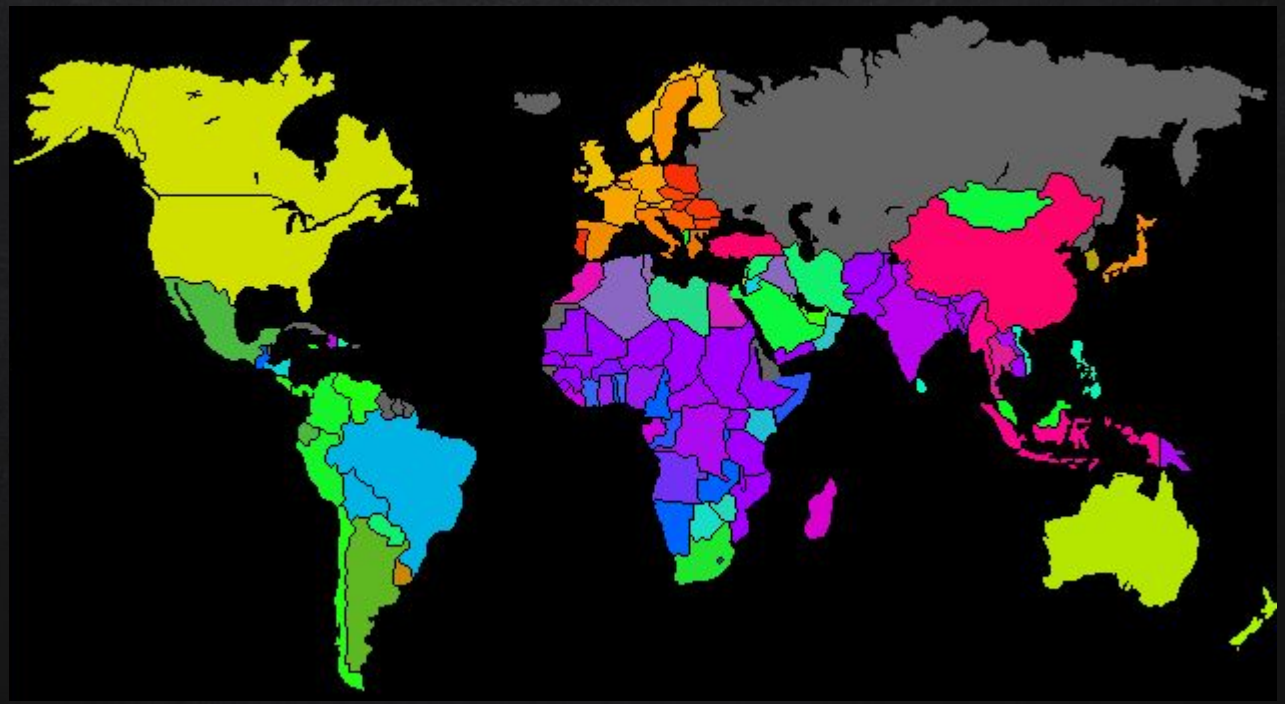


SOMs



http://www.decom.ufop.br/imobilis/self-organizing-maps/

SOMs



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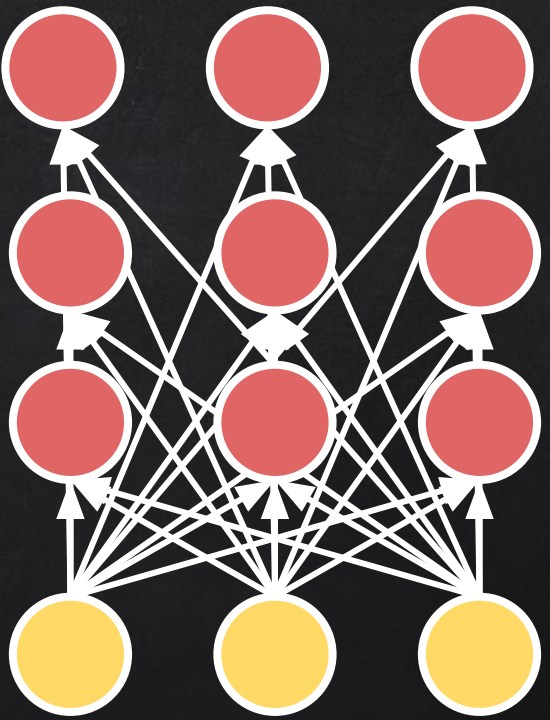
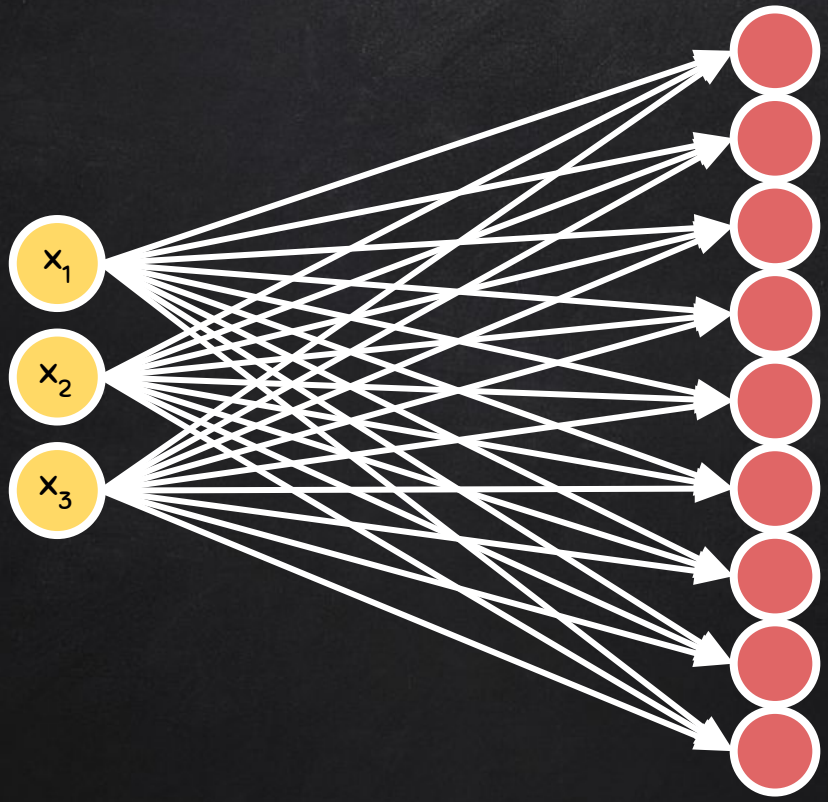
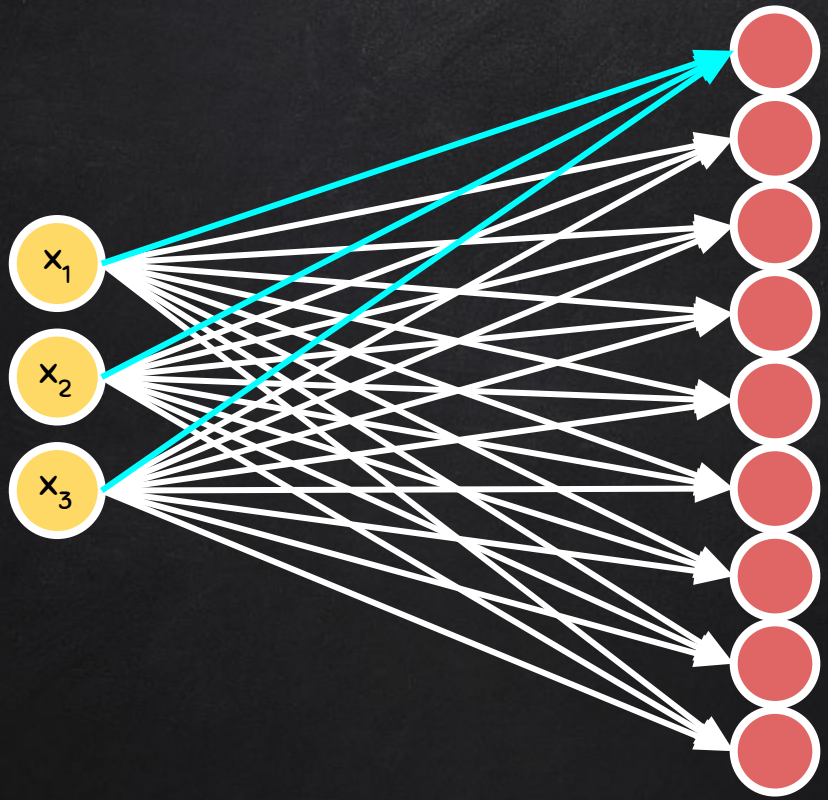
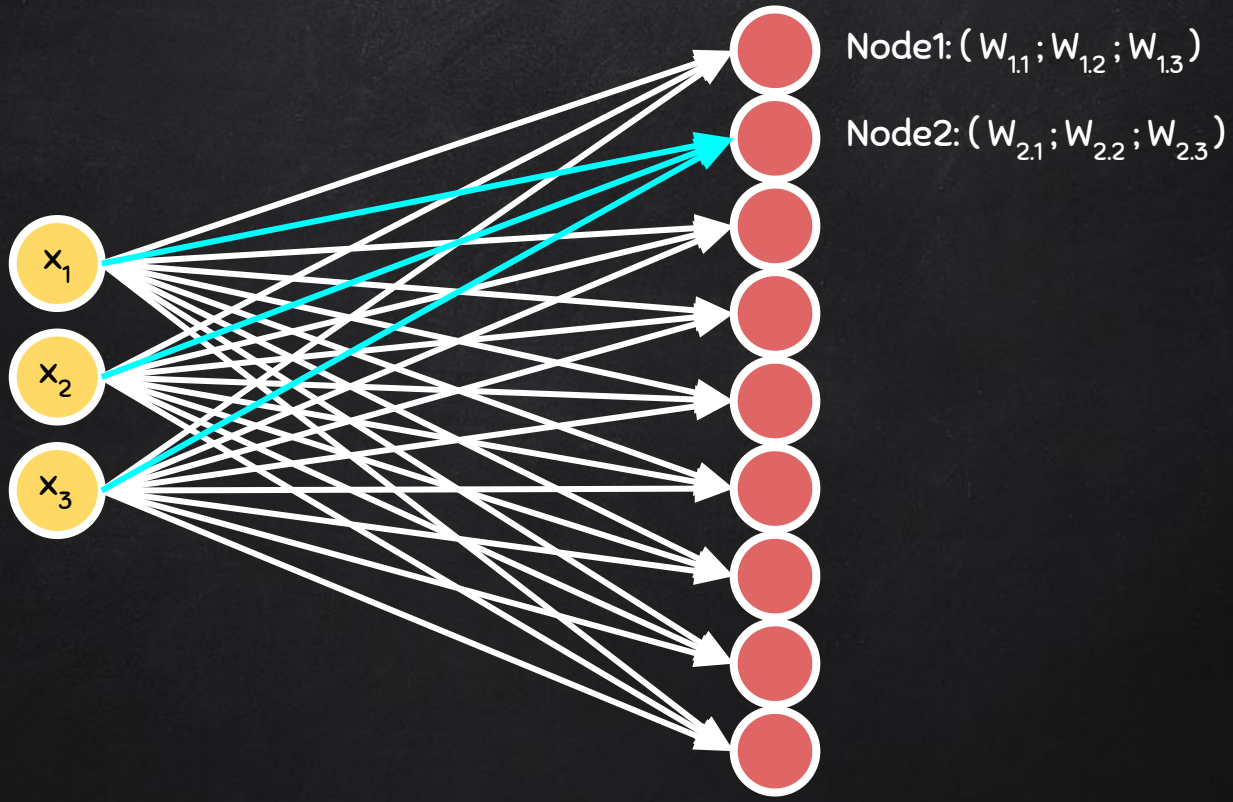
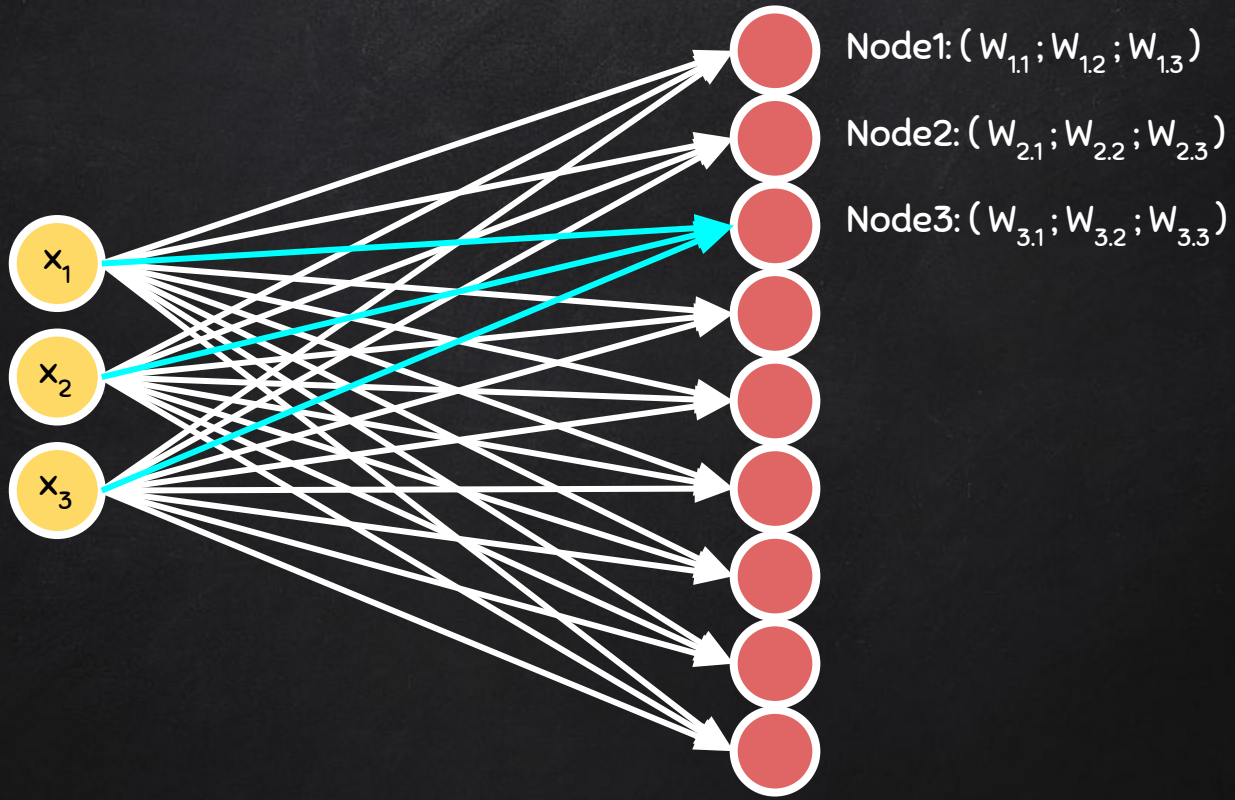
SOM Representation




x_1
x_2
x_3


Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
x_1
x_2
x_3


x_1
x_2
x_3
Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
Node2: ($W_{2.1}$; $W_{2.2}$; $W_{2.3}$)


x_1
x_2
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Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
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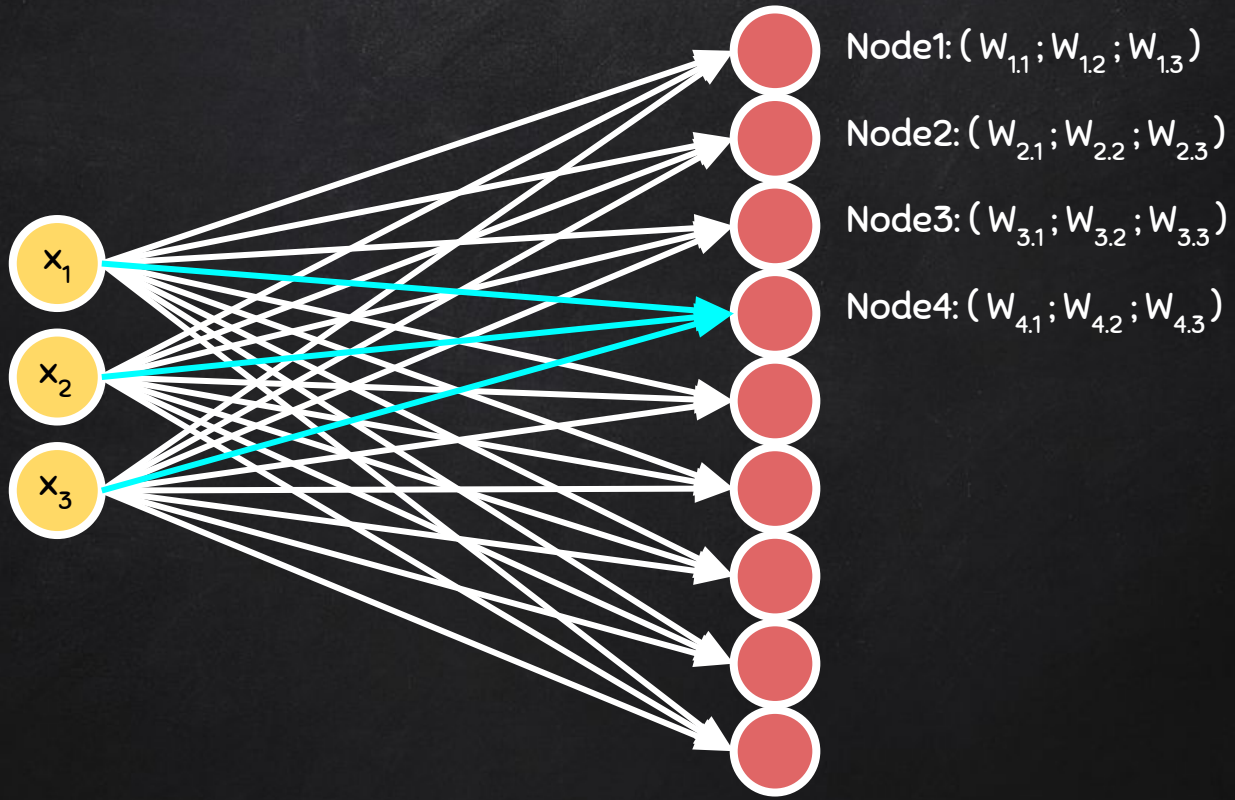
Node3: ($W_{3.1}$; $W_{3.2}$; $W_{3.3}$)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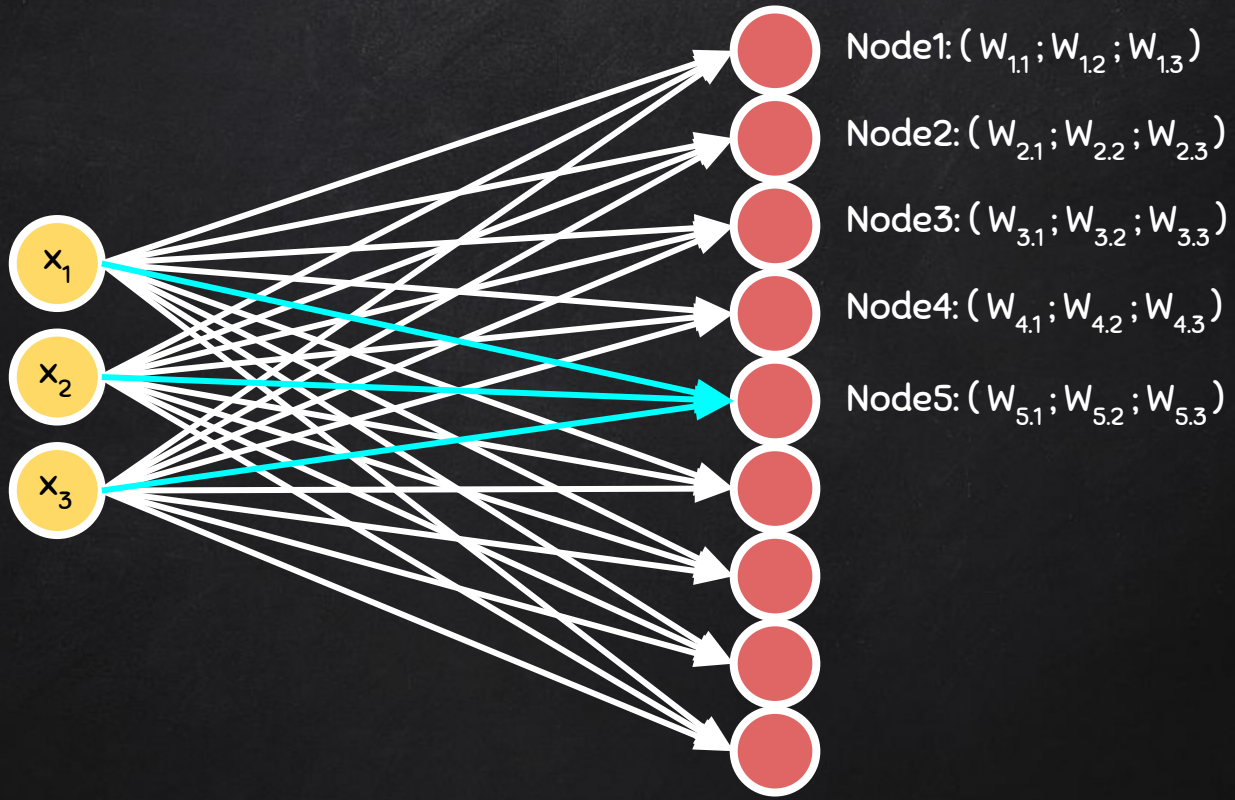
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)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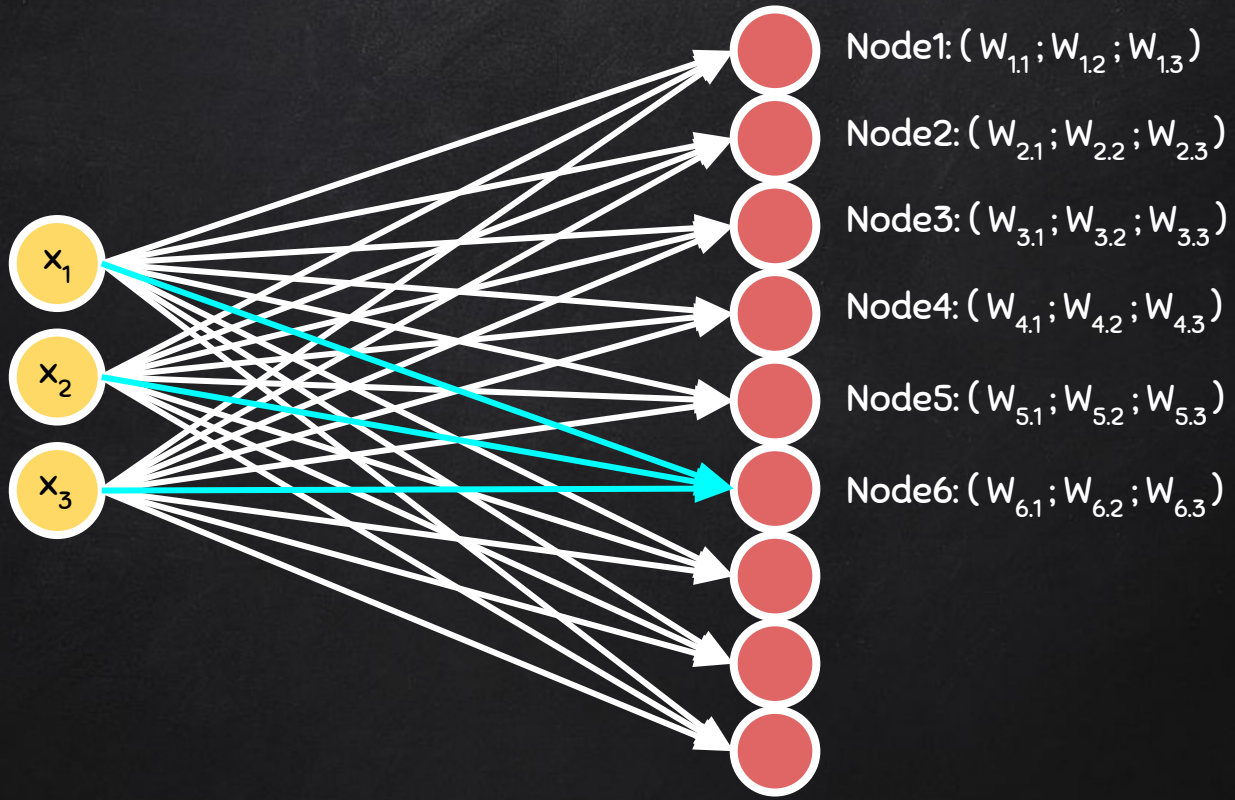
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)
Node5: ($W_{5.1}$; $W_{5.2}$; $W_{5.3}$)


x_1
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Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
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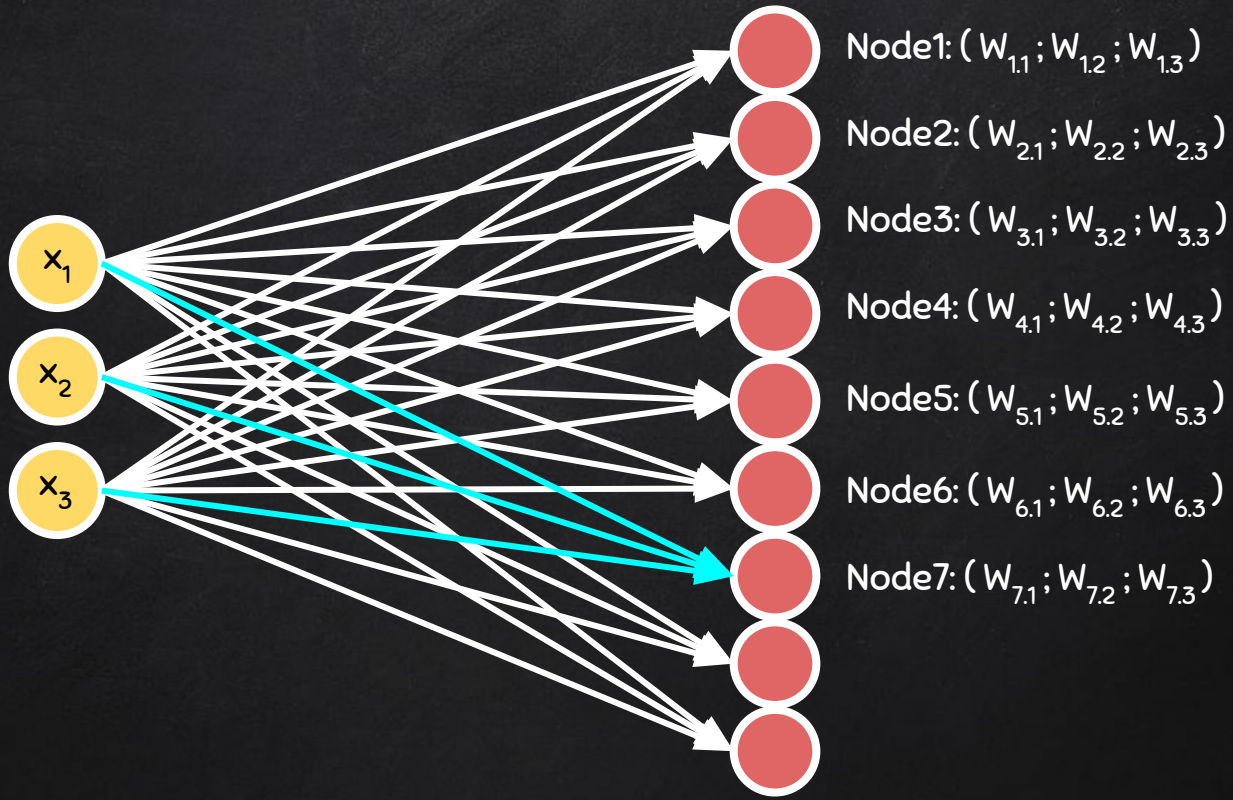
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)
Node5: ($W_{5.1}$; $W_{5.2}$; $W_{5.3}$)
Node6: ($W_{6.1}$; $W_{6.2}$; $W_{6.3}$)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x_2
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Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
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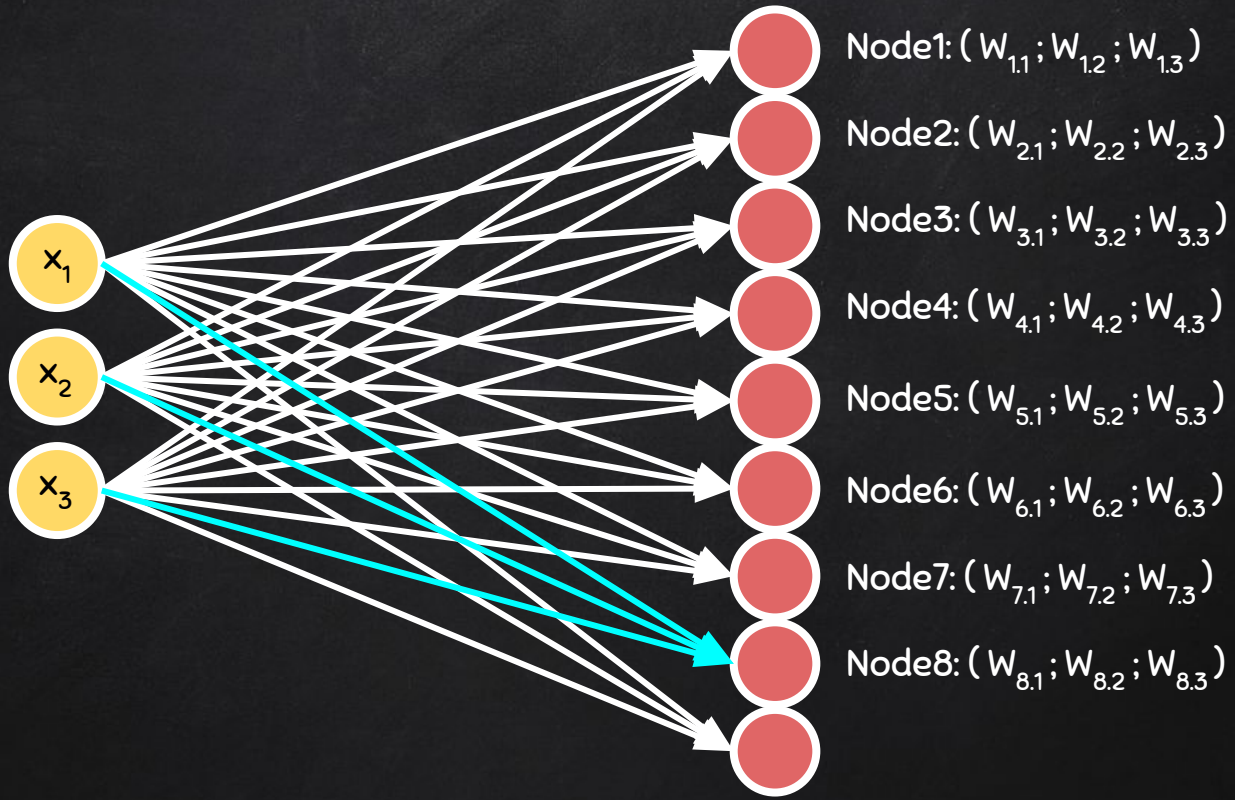
Node3: ($W_{3.1}$; $W_{3.2}$; $W_{3.3}$)
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)
Node5: ($W_{5.1}$; $W_{5.2}$; $W_{5.3}$)
Node6: ($W_{6.1}$; $W_{6.2}$; $W_{6.3}$)
Node7: ($W_{7.1}$; $W_{7.2}$; $W_{7.3}$)


x_1
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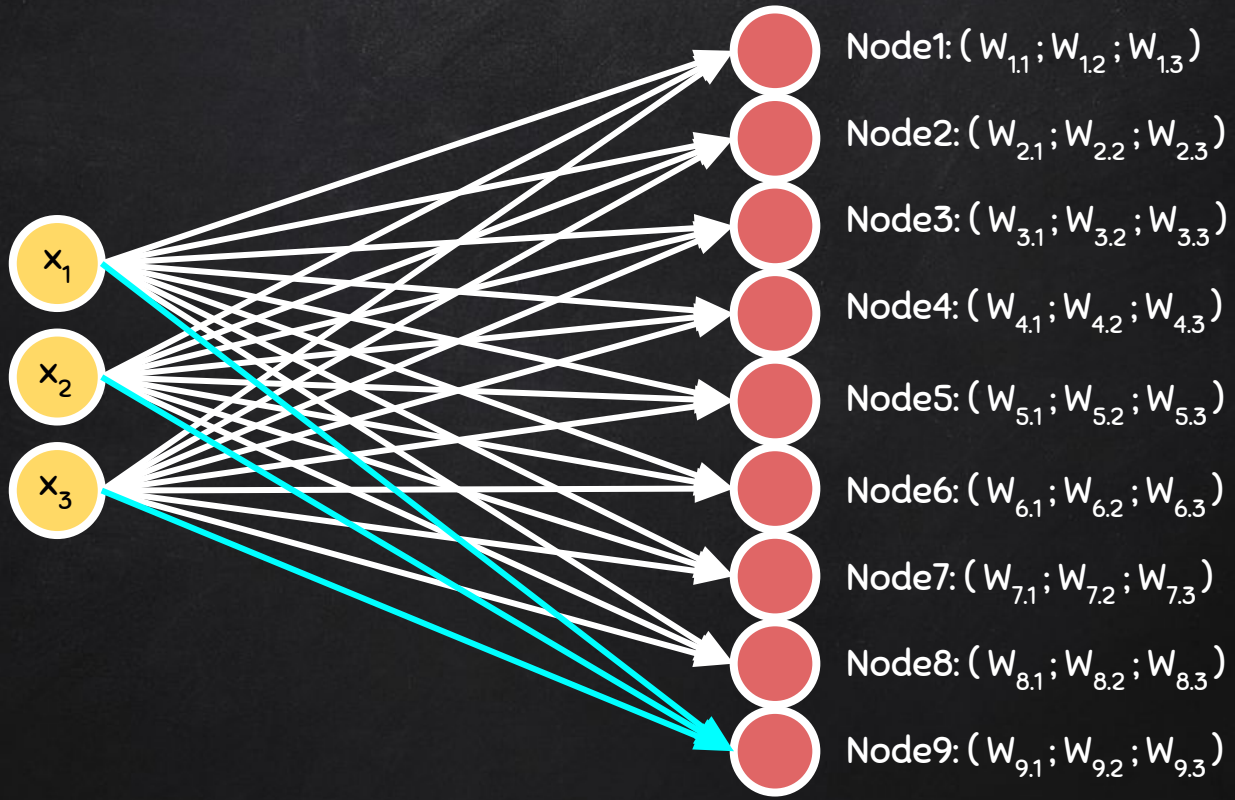
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)
Node5: ($W_{5.1}$; $W_{5.2}$; $W_{5.3}$)
Node6: ($W_{6.1}$; $W_{6.2}$; $W_{6.3}$)
Node7: ($W_{7.1}$; $W_{7.2}$; $W_{7.3}$)
Node8: ($W_{8.1}$; $W_{8.2}$; $W_{8.3}$)


x_1
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Node1: ($W_{1.1}$; $W_{1.2}$; $W_{1.3}$)
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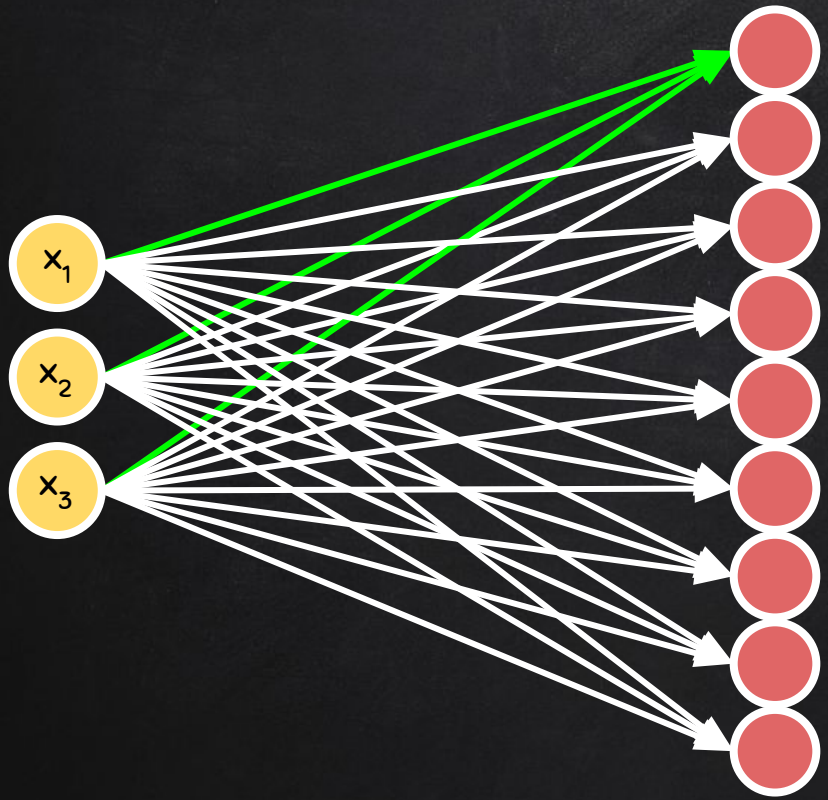
Node3: ($W_{3.1}$; $W_{3.2}$; $W_{3.3}$)
Node4: ($W_{4.1}$; $W_{4.2}$; $W_{4.3}$)
Node5: ($W_{5.1}$; $W_{5.2}$; $W_{5.3}$)
Node6: ($W_{6.1}$; $W_{6.2}$; $W_{6.3}$)
Node7: ($W_{7.1}$; $W_{7.2}$; $W_{7.3}$)
Node8: ($W_{8.1}$; $W_{8.2}$; $W_{8.3}$)
Node9: ($W_{9.1}$; $W_{9.2}$; $W_{9.3}$)



Node1: $(W_{1.1}; W_{1.2}; W_{1.3})$ $Dst = \sqrt{\sum (x_i - w_{1,i})^2}$

Node2: $(W_{2.1}; W_{2.2}; W_{2.3})$ $Dst = \sqrt{\sum (x_i - w_{2,i})^2}$

Node3: $(W_{3.1}; W_{3.2}; W_{3.3})$ $Dst = \sqrt{\sum (x_i - w_{3,i})^2}$

Node4: $(W_{4.1}; W_{4.2}; W_{4.3})$ $Dst = \sqrt{\sum (x_i - w_{4,i})^2}$

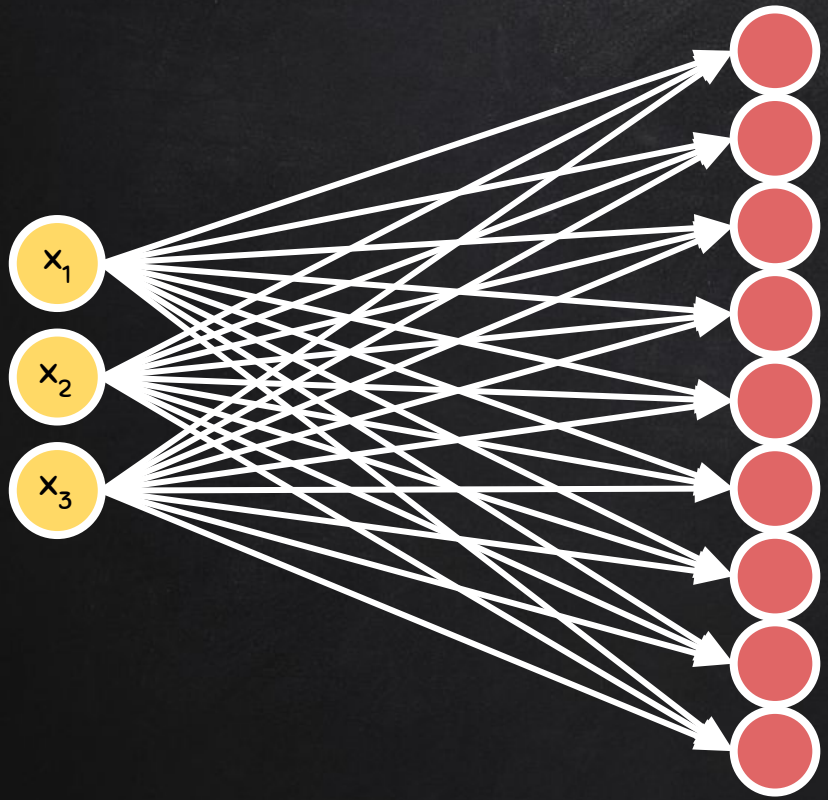
Node5: $(W_{5.1}; W_{5.2}; W_{5.3})$ $Dst = \sqrt{\sum (x_i - w_{5,i})^2}$

Node6: $(W_{6.1}; W_{6.2}; W_{6.3})$ $Dst = \sqrt{\sum (x_i - w_{6,i})^2}$

Node7: $(W_{7.1}; W_{7.2}; W_{7.3})$ $Dst = \sqrt{\sum (x_i - w_{7,i})^2}$

Node8: $(W_{8.1}; W_{8.2}; W_{8.3})$ $Dst = \sqrt{\sum (x_i - w_{8,i})^2}$

Node9: $(W_{9.1}; W_{9.2}; W_{9.3})$ $Dst = \sqrt{\sum (x_i - w_{9,i})^2}$



Node1: $(W_{1.1}; W_{1.2}; W_{1.3})$ $Dst = \sqrt{\sum (x_i - w_{1,i})^2} = 1.2$

Node2: $(W_{2.1}; W_{2.2}; W_{2.3})$ $Dst = \sqrt{\sum (x_i - w_{2,i})^2} = 0.8$

Node3: $(W_{3.1}; W_{3.2}; W_{3.3})$ $Dst = \sqrt{\sum (x_i - w_{3,i})^2} = 0.4$

Node4: $(W_{4.1}; W_{4.2}; W_{4.3})$ $Dst = \sqrt{\sum (x_i - w_{4,i})^2} = 1.1$

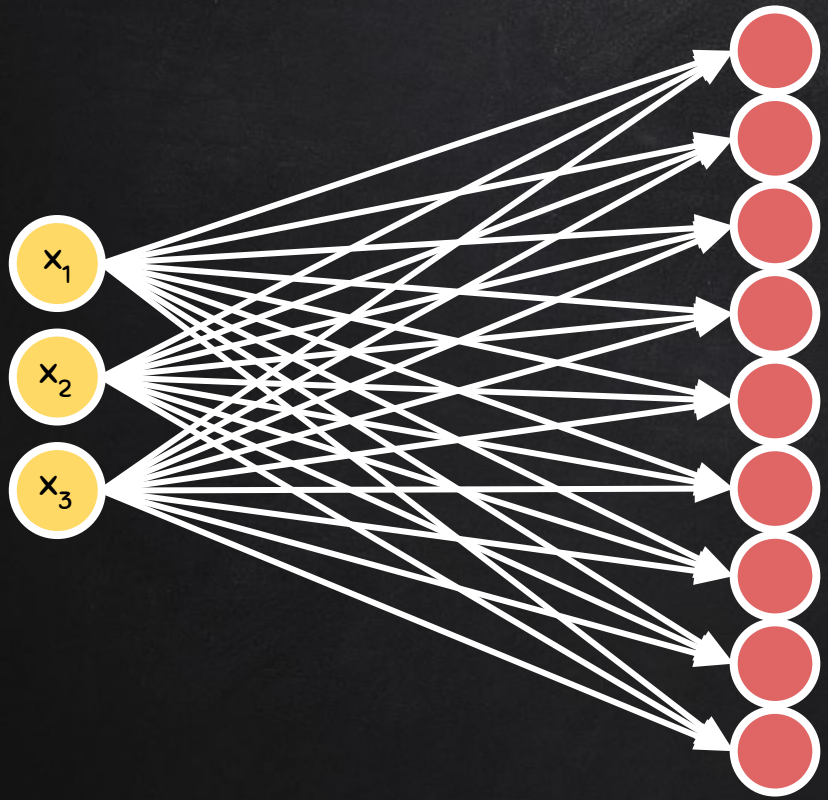
Node5: $(W_{5.1}; W_{5.2}; W_{5.3})$ $Dst = \sqrt{\sum (x_i - w_{5,i})^2} = 1.3$

Node6: $(W_{6.1}; W_{6.2}; W_{6.3})$ $Dst = \sqrt{\sum (x_i - w_{6,i})^2} = 1.0$

Node7: $(W_{7.1}; W_{7.2}; W_{7.3})$ $Dst = \sqrt{\sum (x_i - w_{7,i})^2} = 0.6$

Node8: $(W_{8.1}; W_{8.2}; W_{8.3})$ $Dst = \sqrt{\sum (x_i - w_{8,i})^2} = 1.2$

Node9: $(W_{9.1}; W_{9.2}; W_{9.3})$ $Dst = \sqrt{\sum (x_i - w_{9,i})^2} = 0.9$



Node1: $(W_{1.1}; W_{1.2}; W_{1.3})$ $Dst = \sqrt{\sum (x_i - w_{1,i})^2} = 1.2$

Node2: $(W_{2.1}; W_{2.2}; W_{2.3})$ $Dst = \sqrt{\sum (x_i - w_{2,i})^2} = 0.8$

Node3: $(W_{3.1}; W_{3.2}; W_{3.3})$ $Dst = \sqrt{\sum (x_i - w_{3,i})^2} = 0.4$

Node4: $(W_{4.1}; W_{4.2}; W_{4.3})$ $Dst = \sqrt{\sum (x_i - w_{4,i})^2} = 1.1$

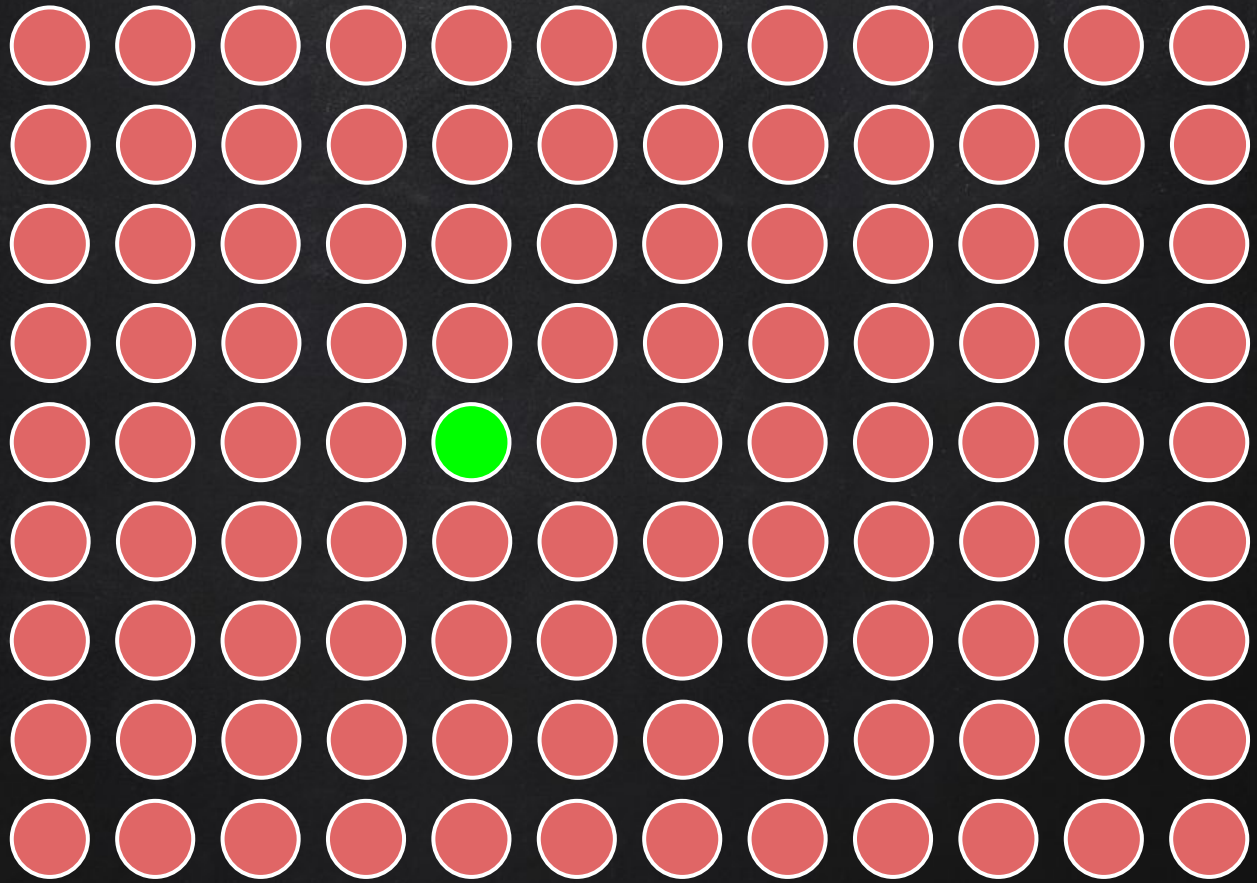
Node5: $(W_{5.1}; W_{5.2}; W_{5.3})$ $Dst = \sqrt{\sum (x_i - w_{5,i})^2} = 1.3$

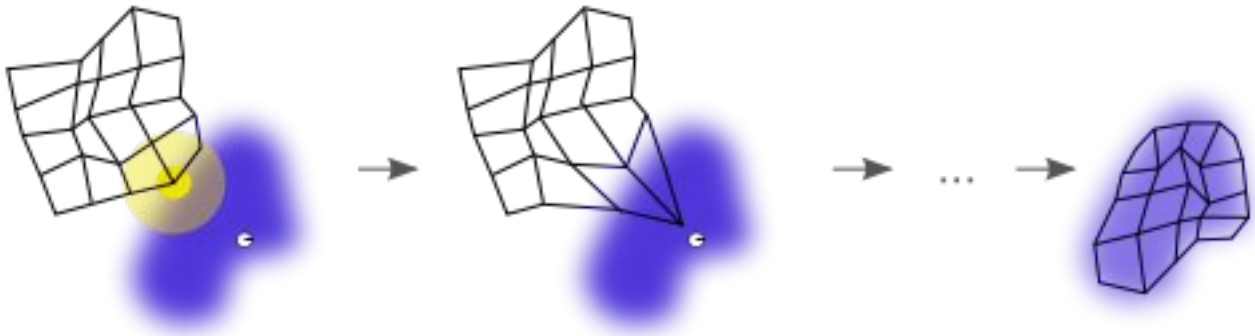
Node6: $(W_{6.1}; W_{6.2}; W_{6.3})$ $Dst = \sqrt{\sum (x_i - w_{6,i})^2} = 1.0$

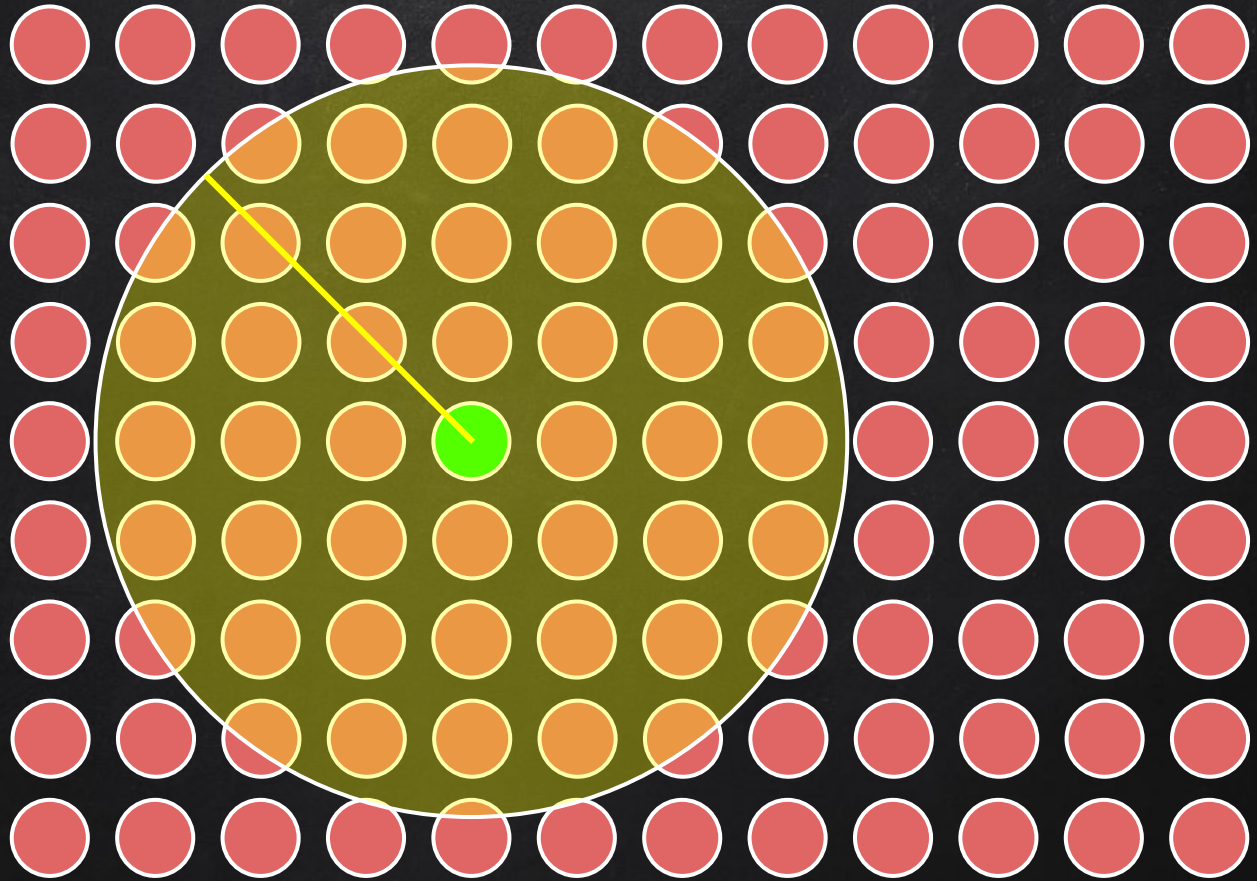
Node7: $(W_{7.1}; W_{7.2}; W_{7.3})$ $Dst = \sqrt{\sum (x_i - w_{7,i})^2} = 0.6$

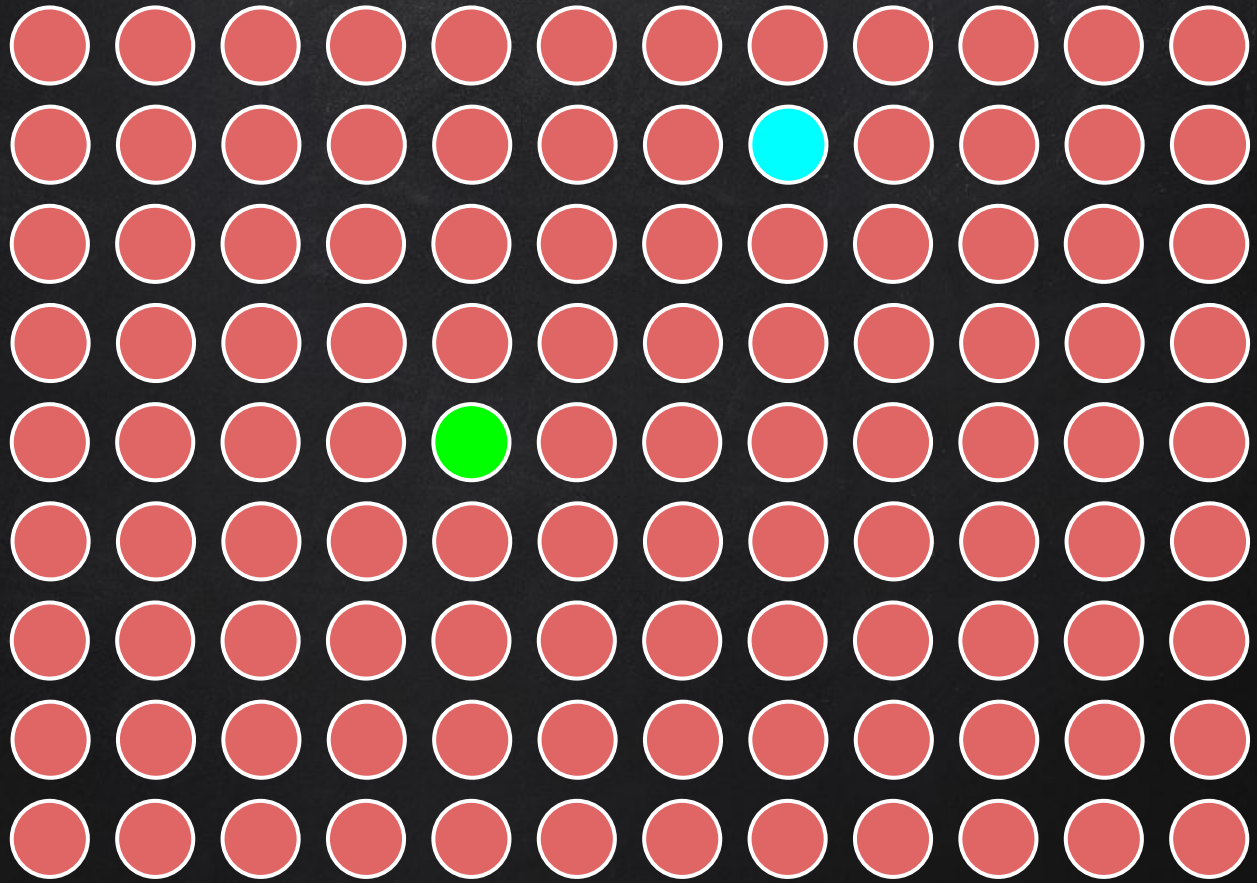
Node8: $(W_{8.1}; W_{8.2}; W_{8.3})$ $Dst = \sqrt{\sum (x_i - w_{8,i})^2} = 1.2$

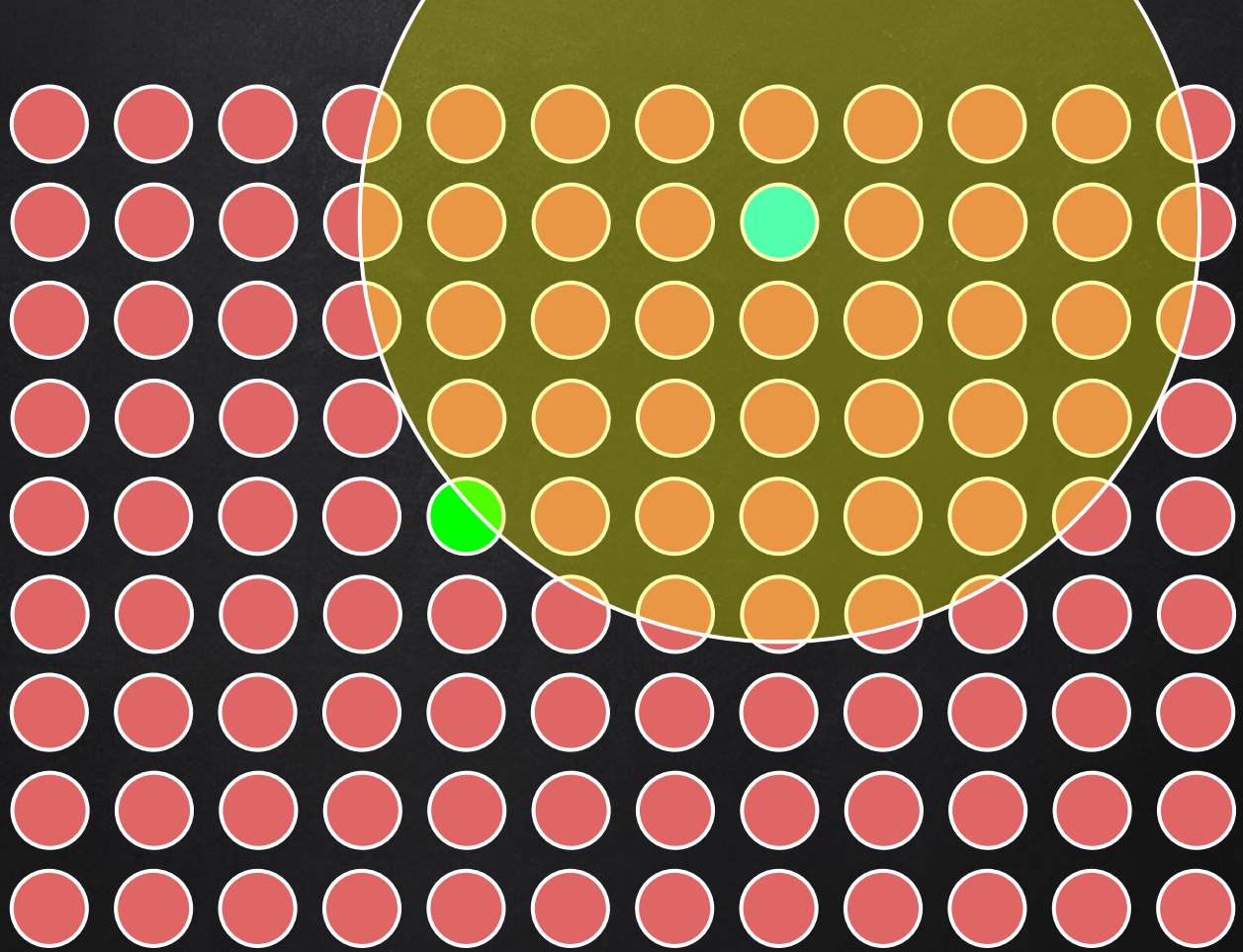
Node9: $(W_{9.1}; W_{9.2}; W_{9.3})$ $Dst = \sqrt{\sum (x_i - w_{9,i})^2} = 0.9$

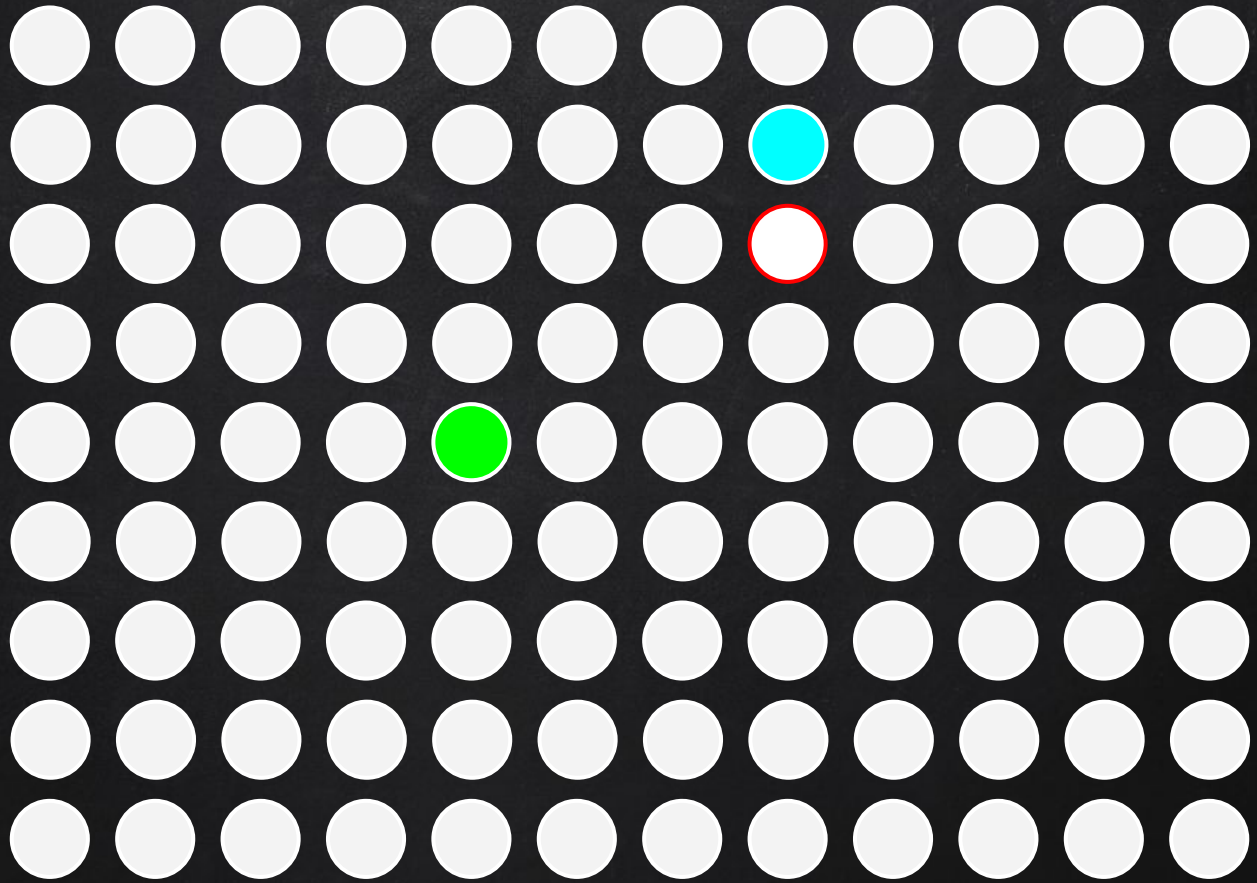


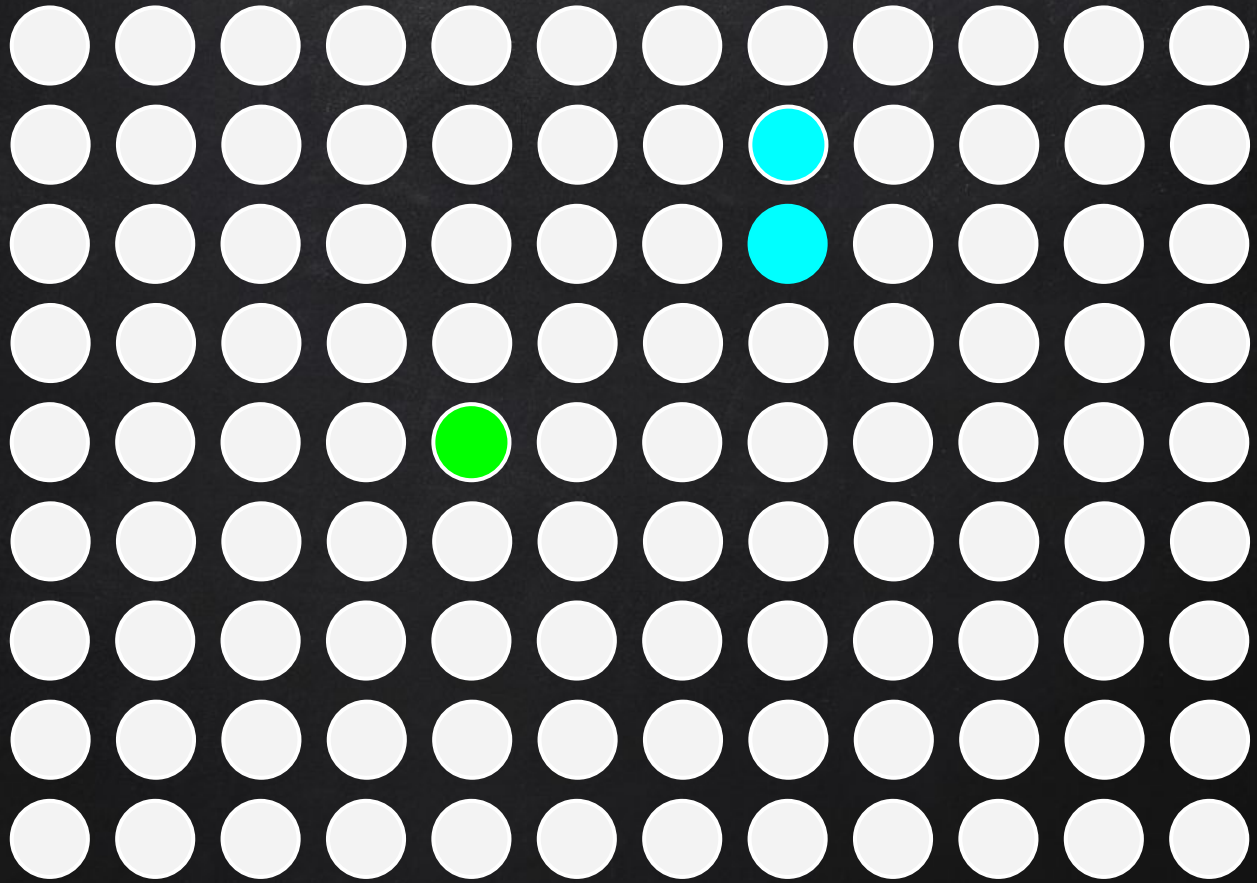


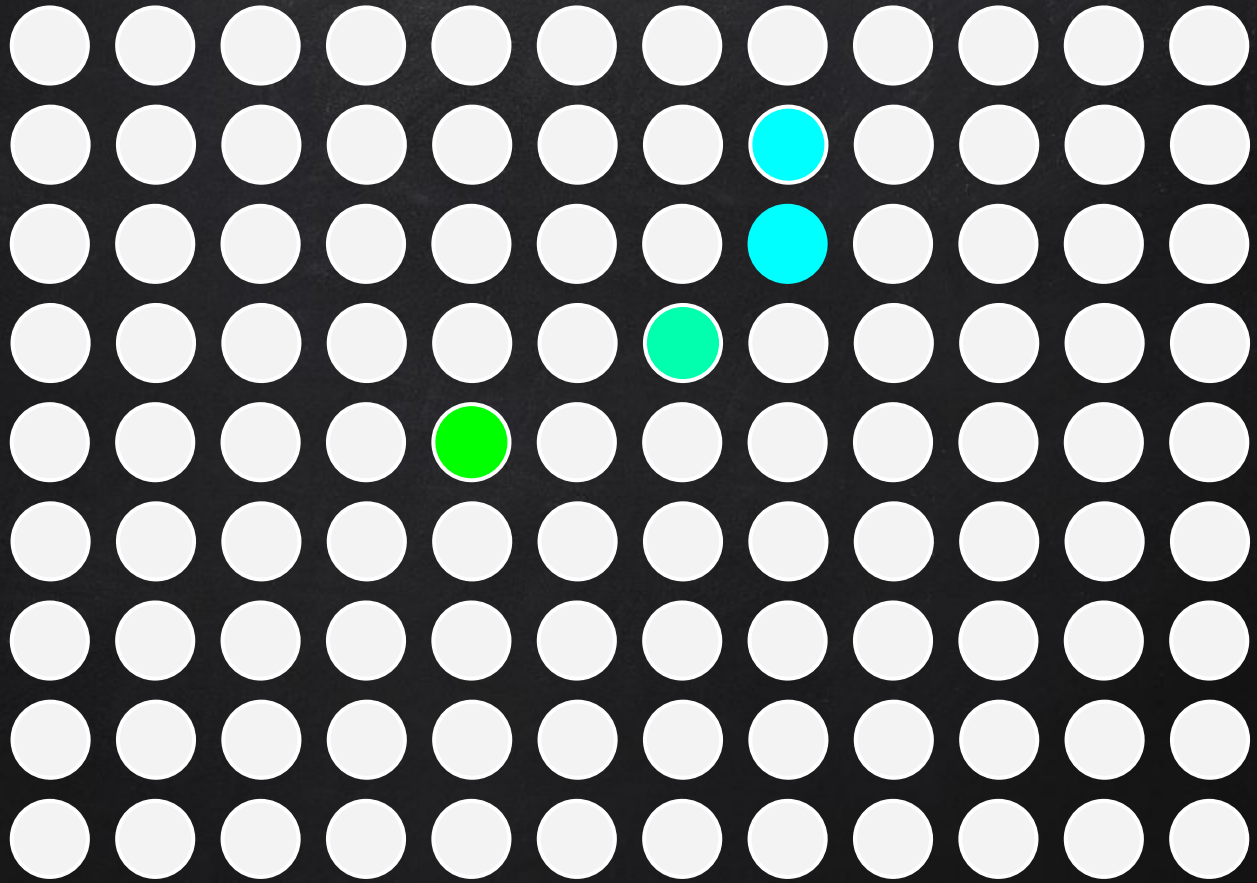


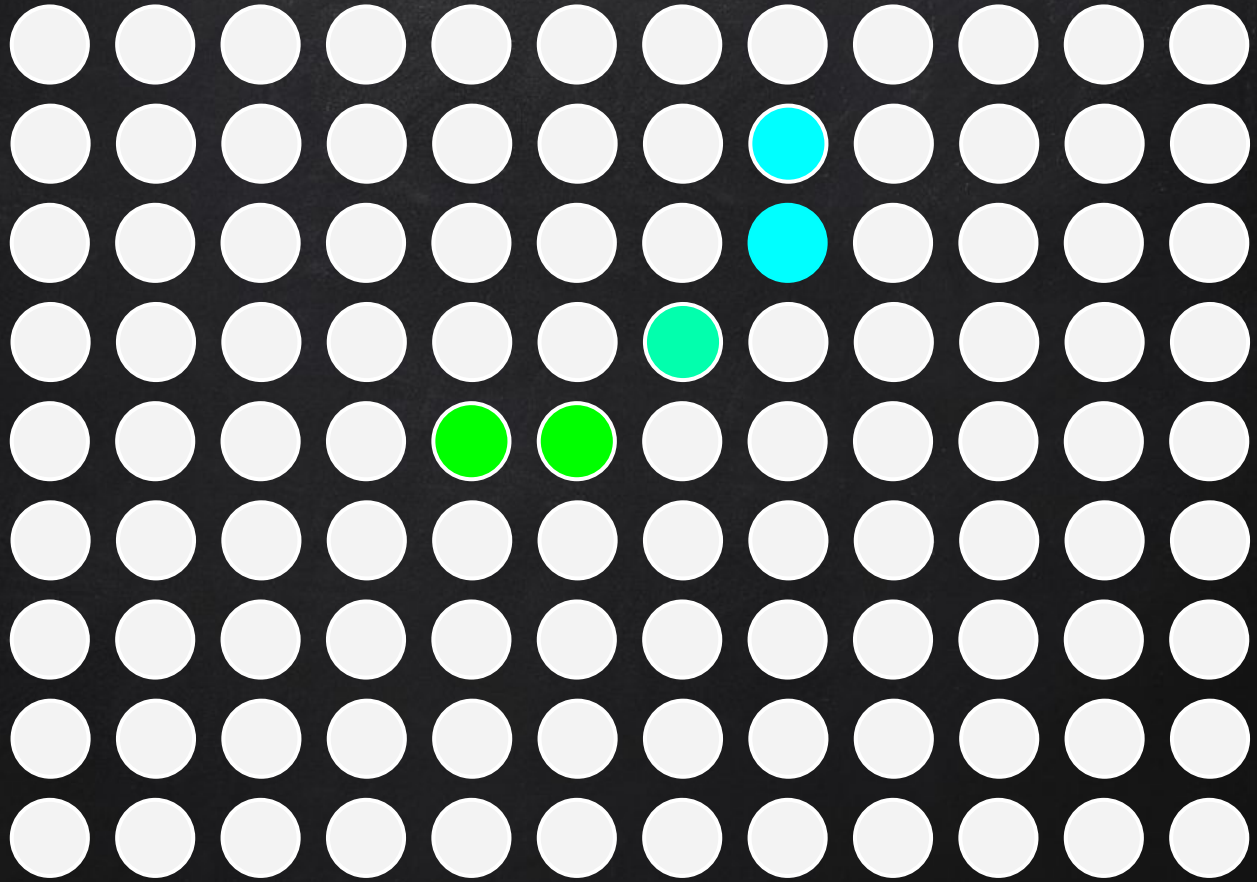






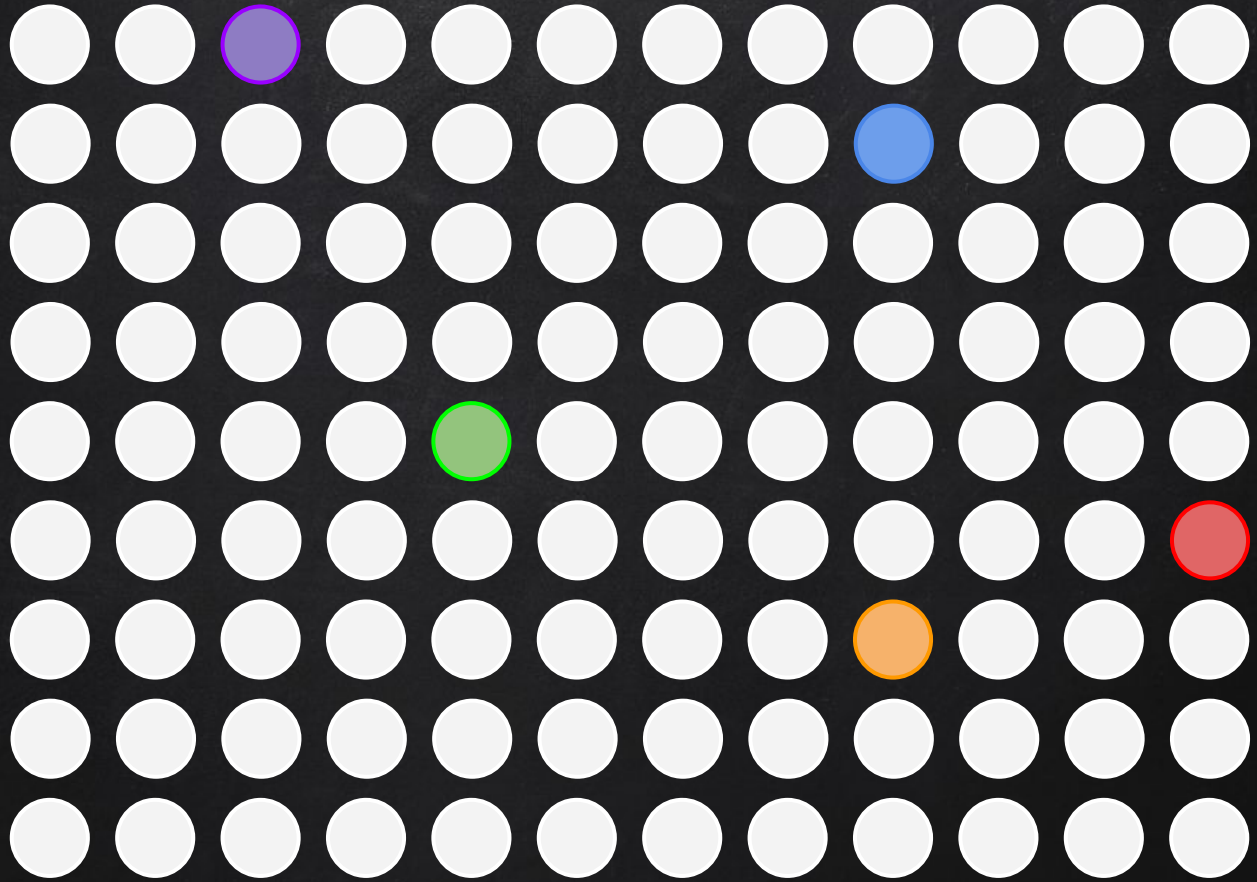


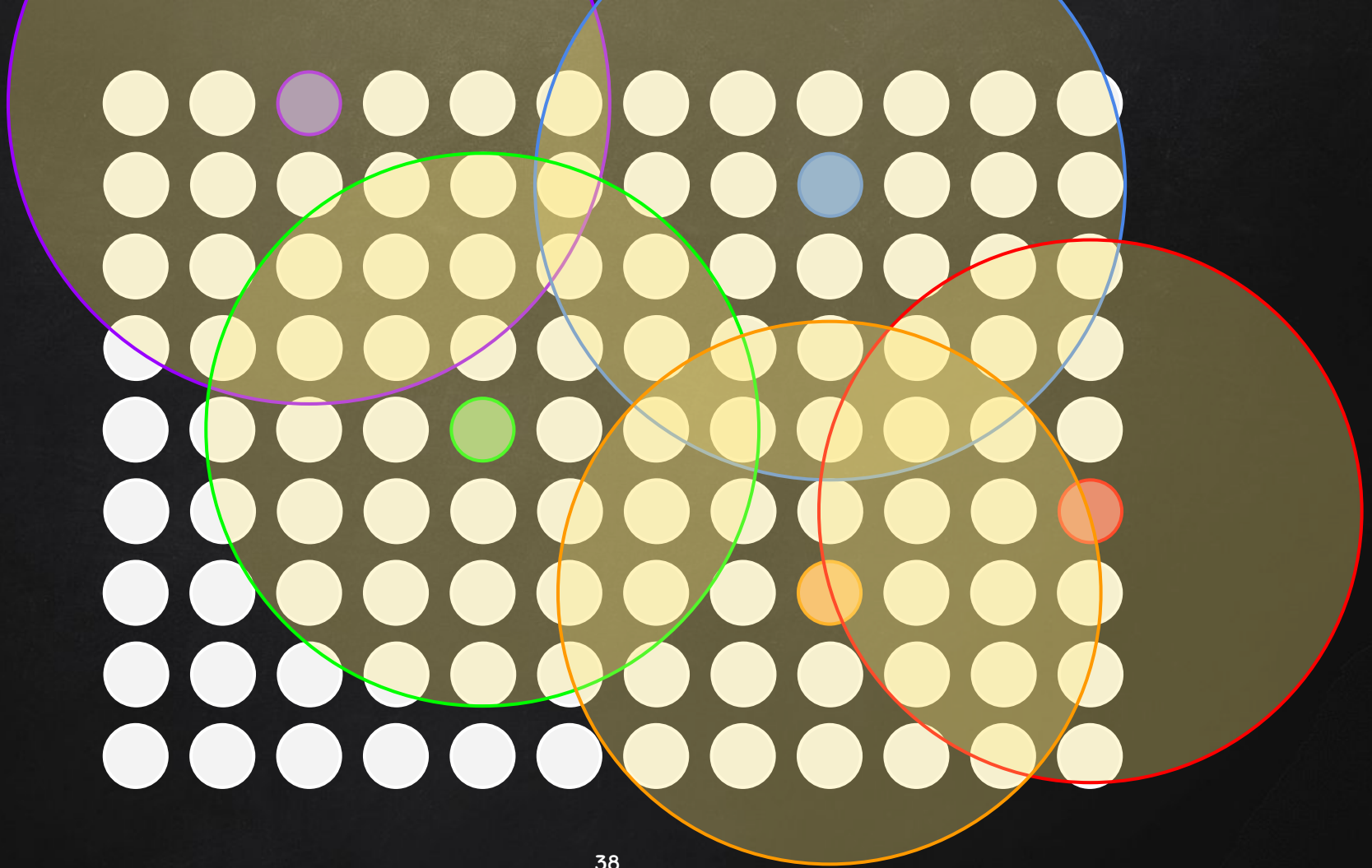


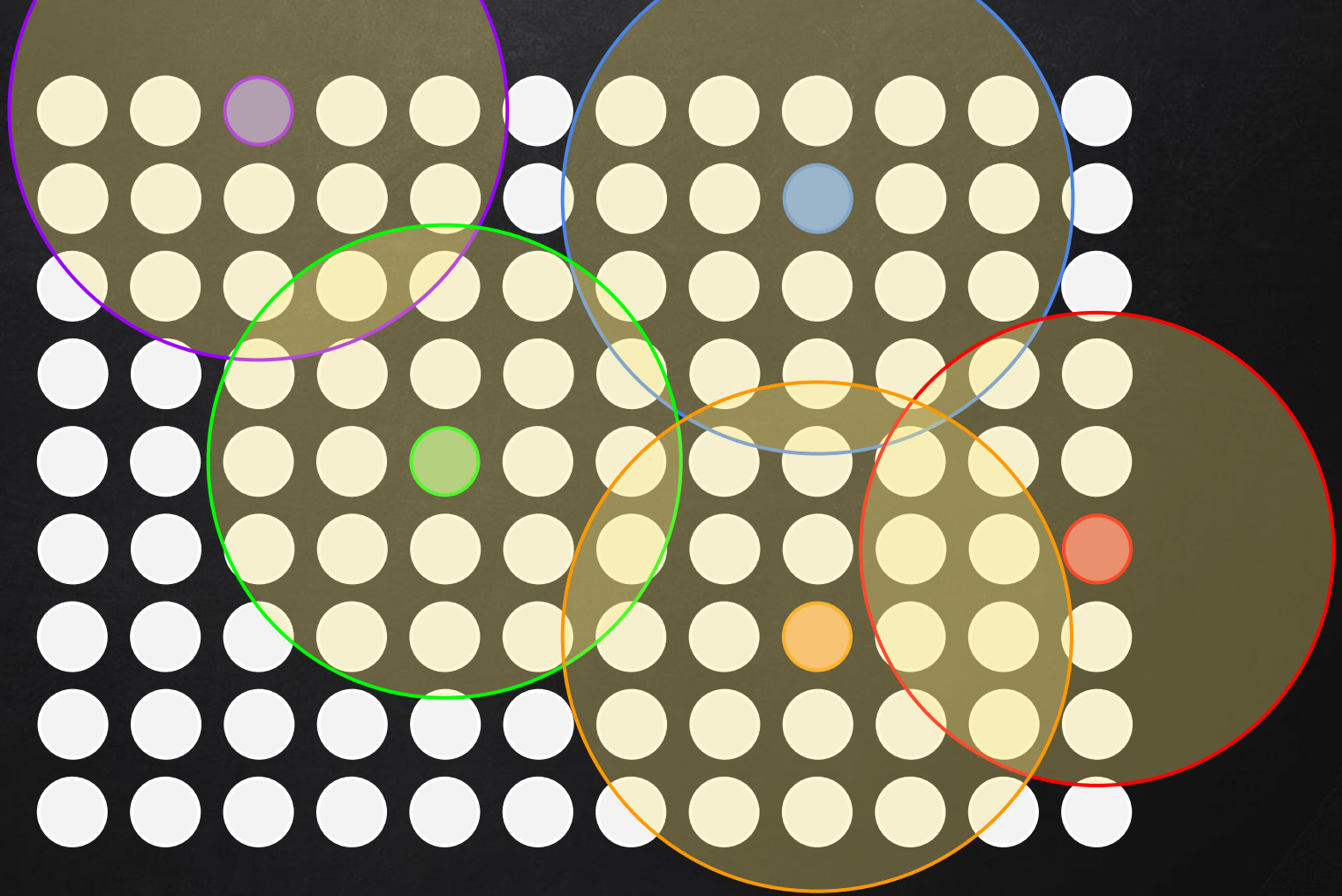


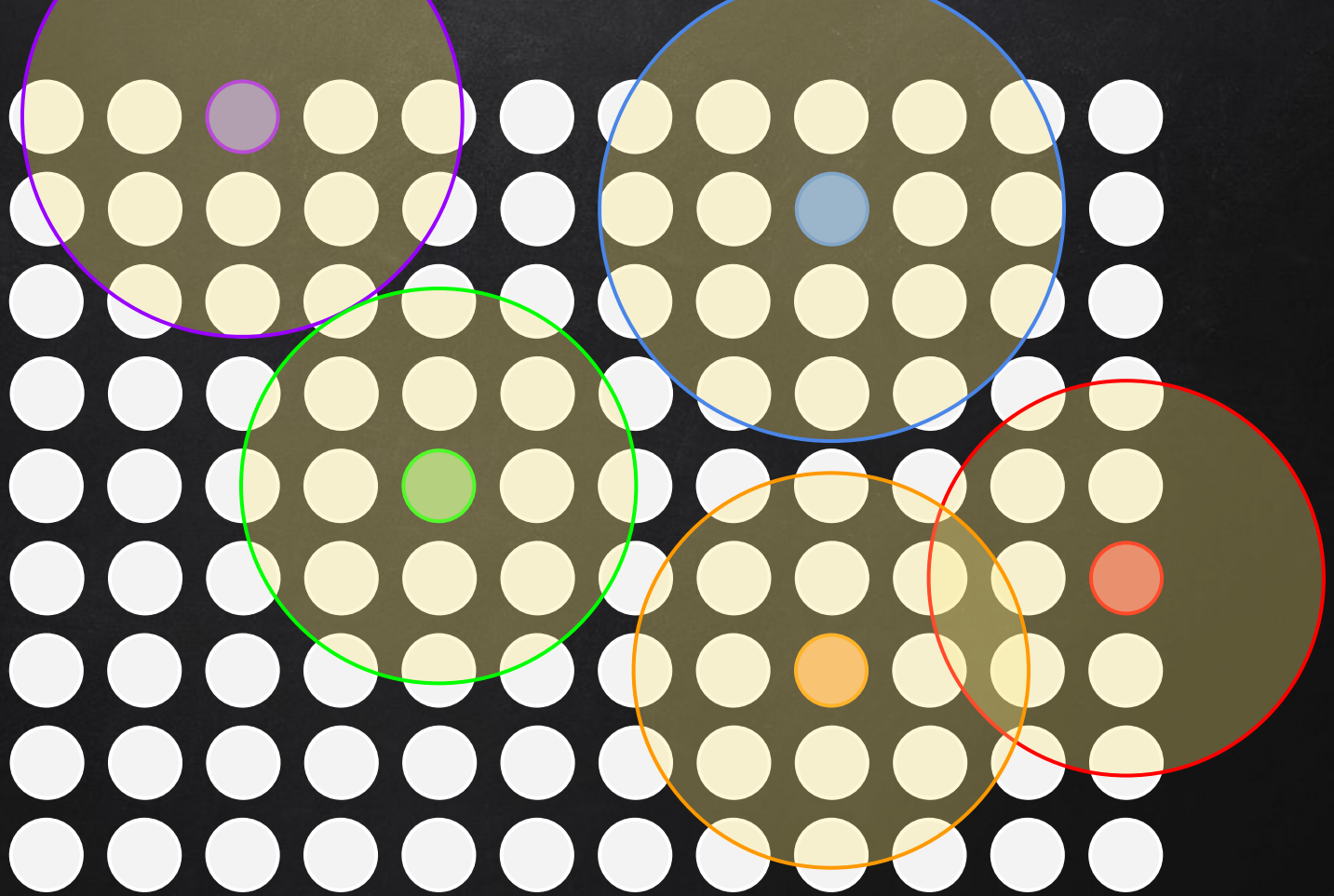
Como os SOMs Aprendem

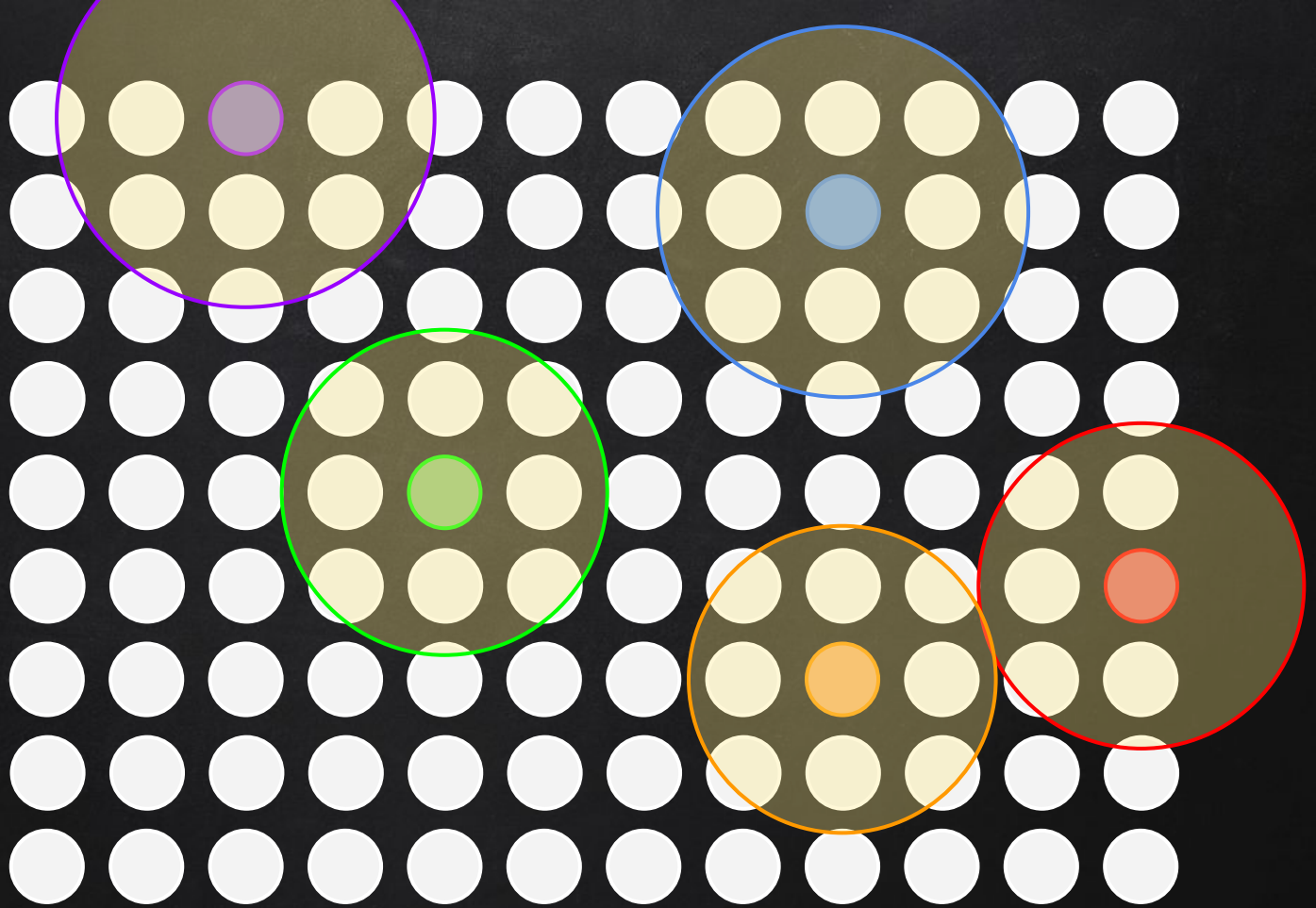
Self Organizing Maps

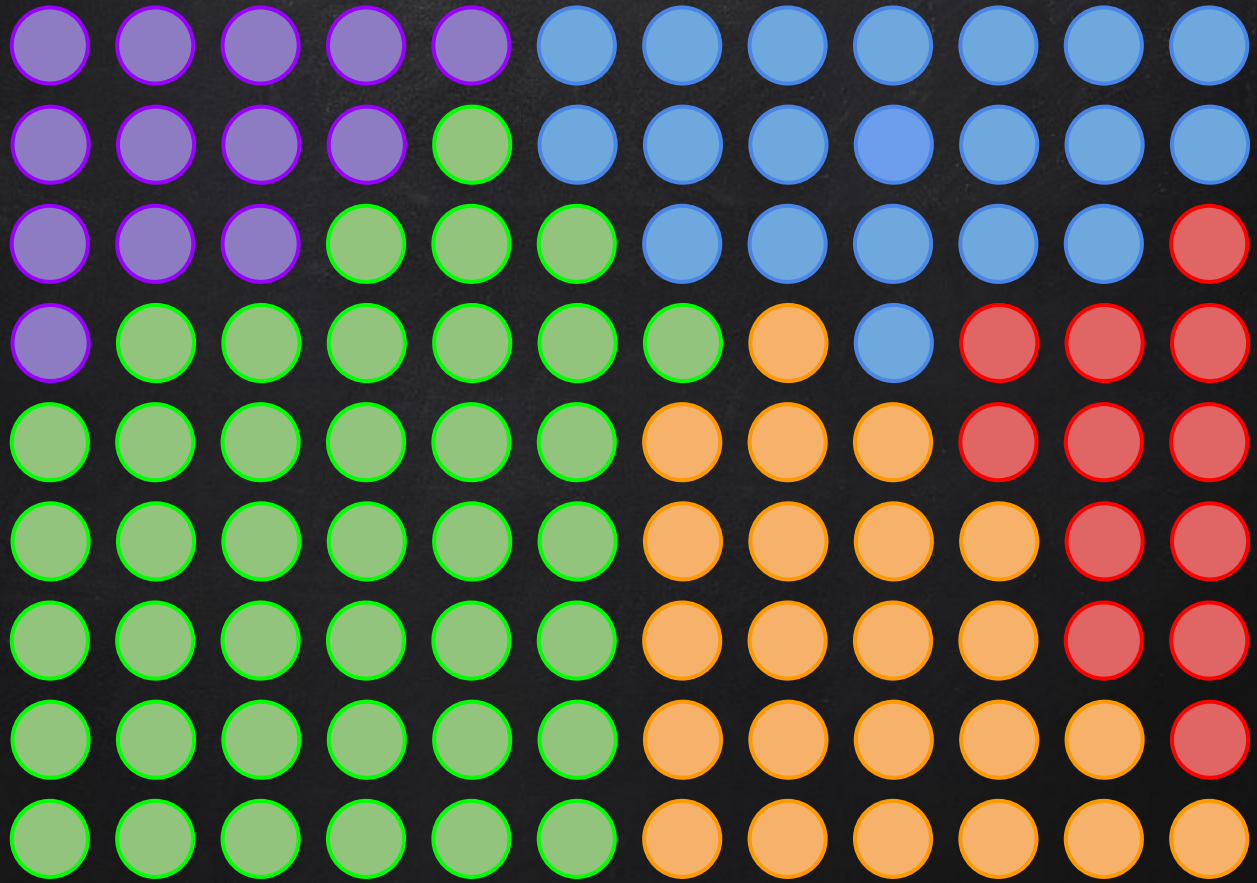












Fácil...

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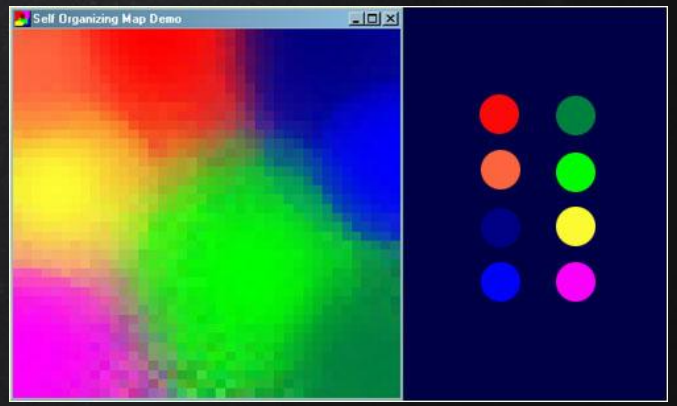
5. Não tem conexões laterais entre os nodes de saída

IMPORTANTE!

Leitura Adicional:

Kohonen's Self Organizing Feature Maps

Mat Buckland (2004)

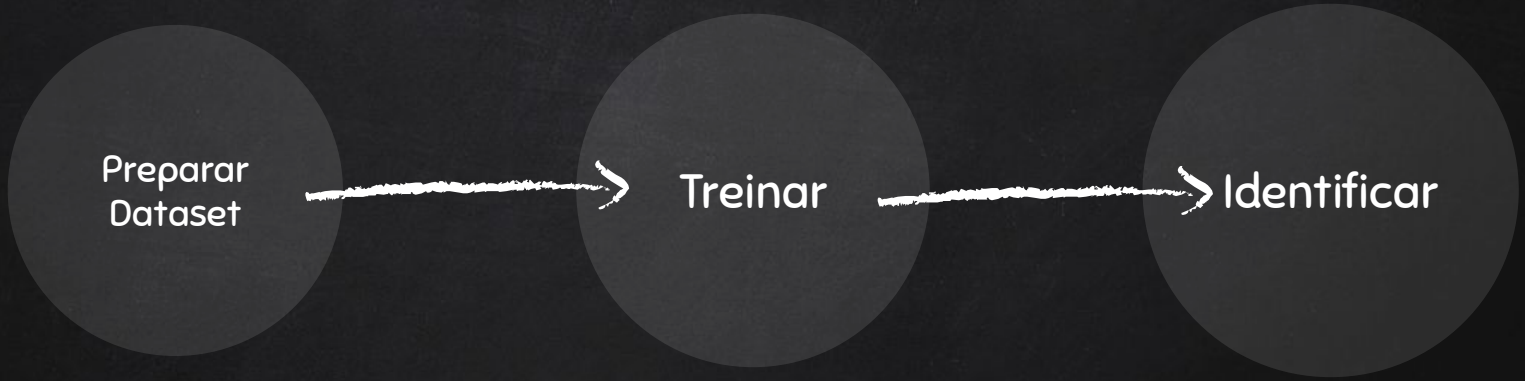


http://www.ai-junkie.com/ann/som/som1.html

Prática
Building SOM

Identificando Fraudes Bancárias

Building CNN



https://github.com/deeplearningunb/building-som

Dever de Casa...

Valendo nota =)

1. No repositório do seu projeto
2. Use o SOM para mapear seu dataset
3. Salve o mapa gerado e
4. Descreva seus achados em um Jupyter Notebook

Obrigado!

Dúvidas?

http://bit.ly/dl-unb8
https://t.me/DeepLearningUnB
@diegodorgam

Credits

Special thanks to all the people who made and released these awesome resources for free:

- ✘ Presentation template by SlidesCarnival
- ✘ Photographs by Unsplash