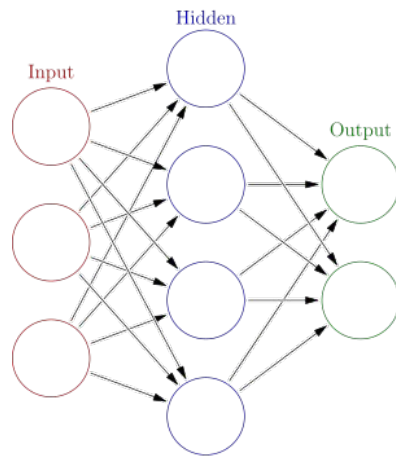
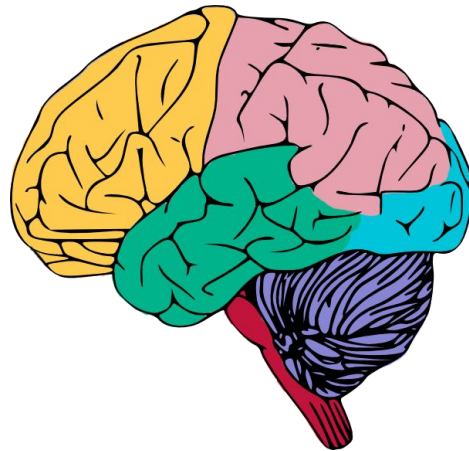
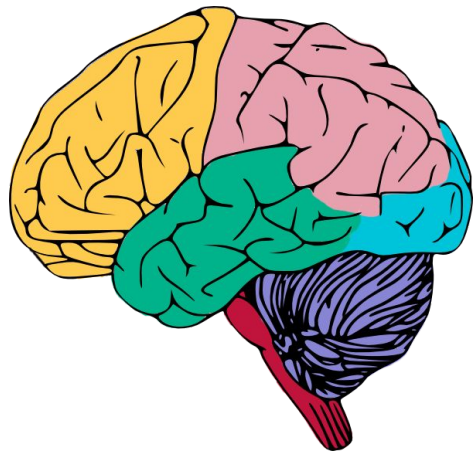


Nyelvtech

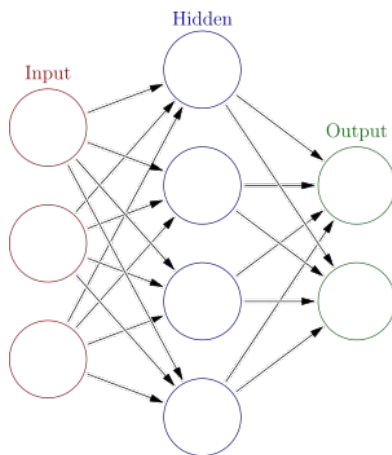
BOTOS CSABI





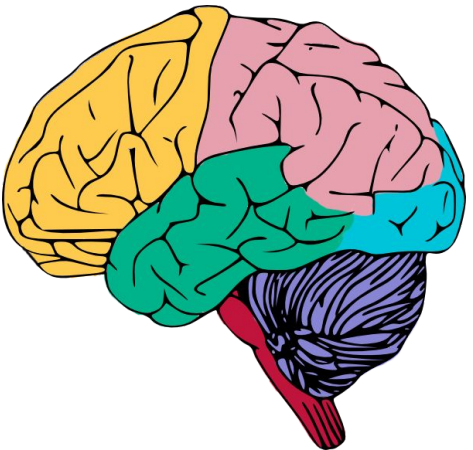


+



=





↗ C.





This bird is red and brown in color, with a stubby beak



The bird is short and stubby with yellow on its body



A bird with a medium orange bill white body gray wings and webbed feet



This small black bird has a short, slightly curved bill and long legs



A small bird with varying shades of brown with white under the eyes



A small yellow bird with a black crown and a short black pointed beak

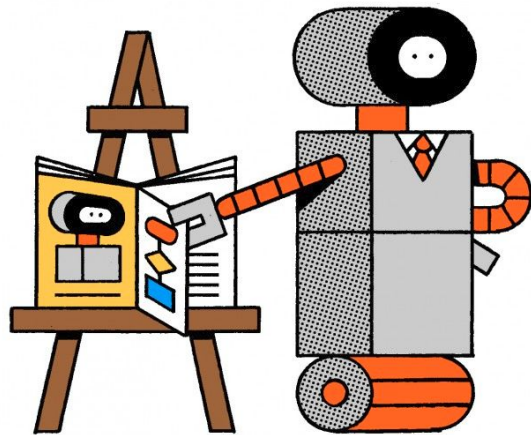


This small bird has a white breast, light grey head, and black wings and tail

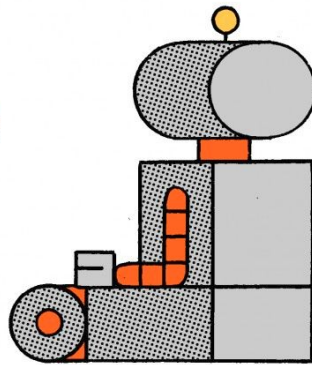
Text to Photo - realistic Image Synthesis by Zhang *et al.*

Unsupervised Learning

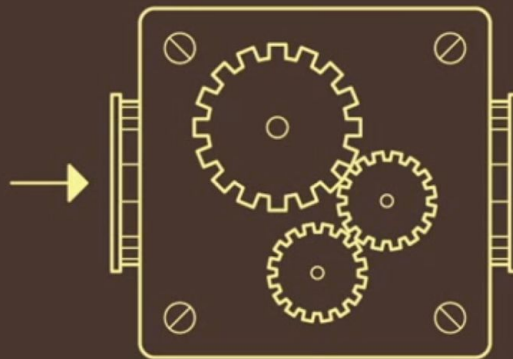
Szöveg feldolgozás
(RNN)



Kép generálás
(GAN)



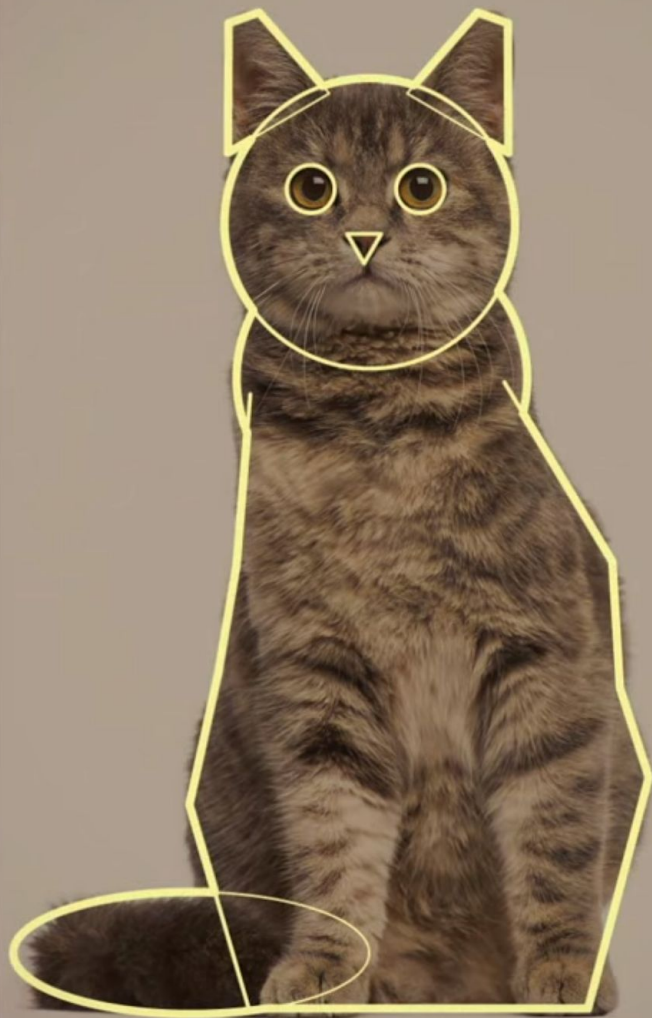
Objektív feladat



“Cat”



Credits: Fei Fei Li



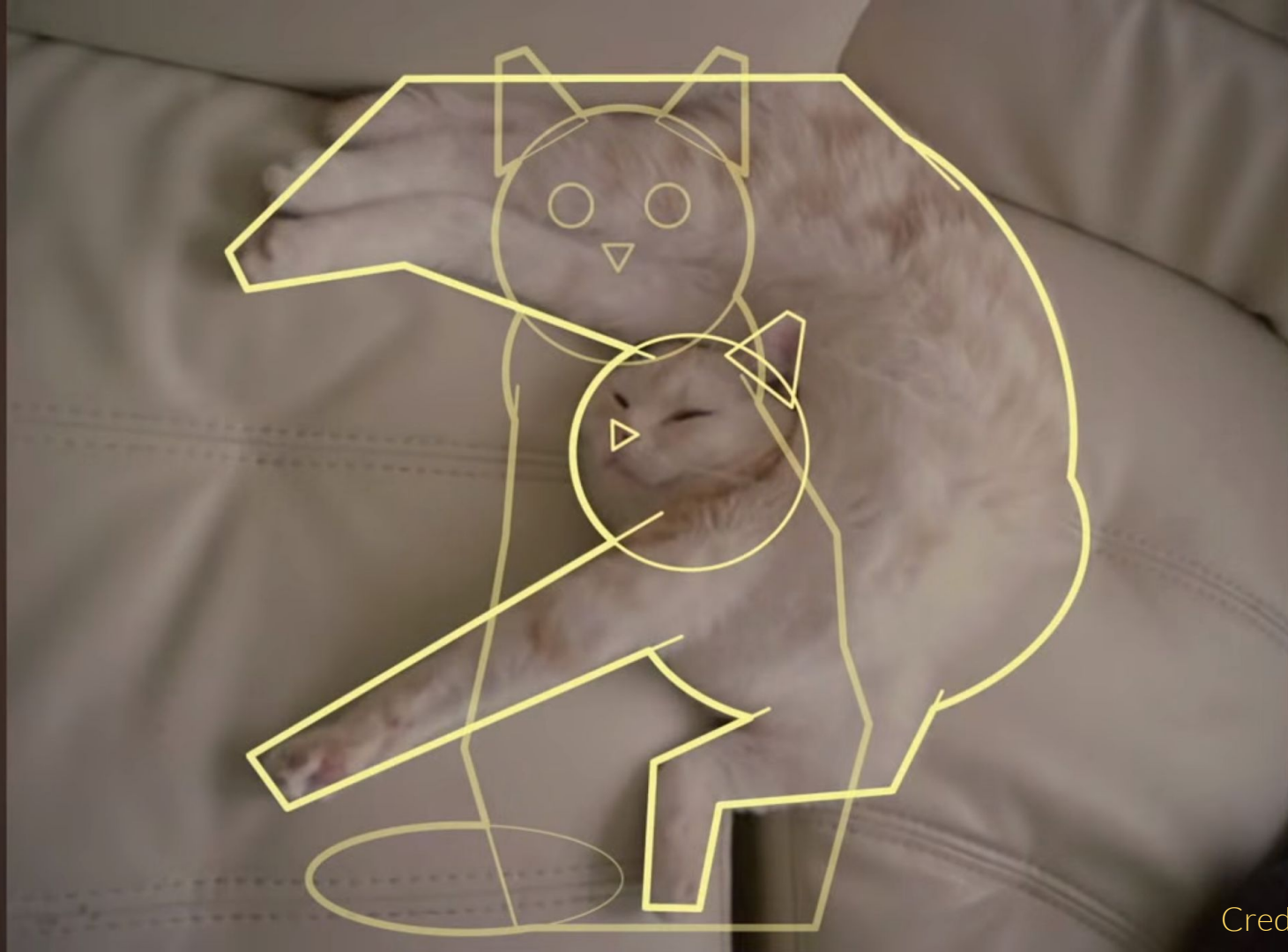
Credits: Fei Fei Li



“Cat”



Credits: Fei Fei Li

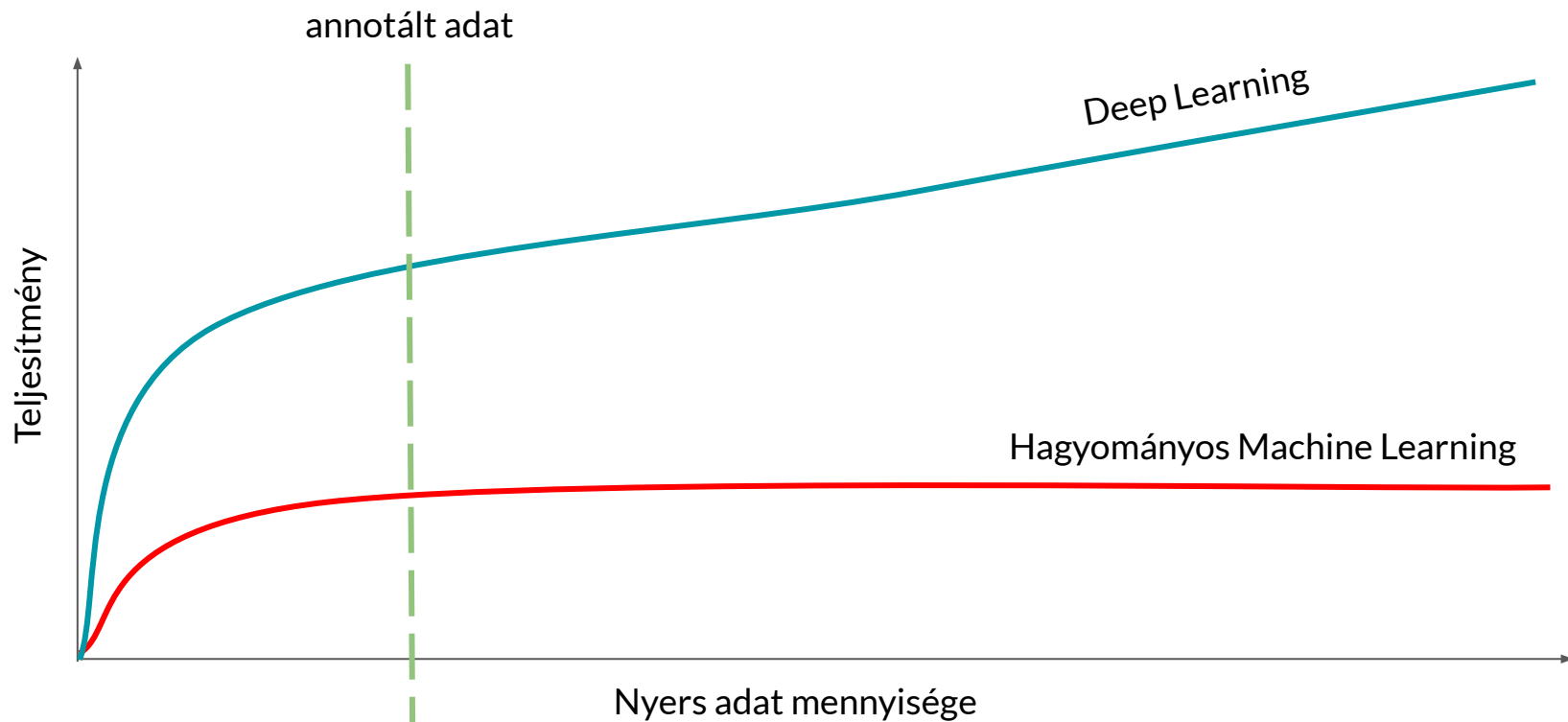


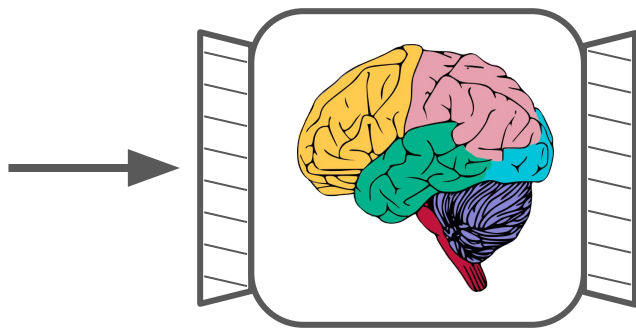
Credits: Fei Fei Li



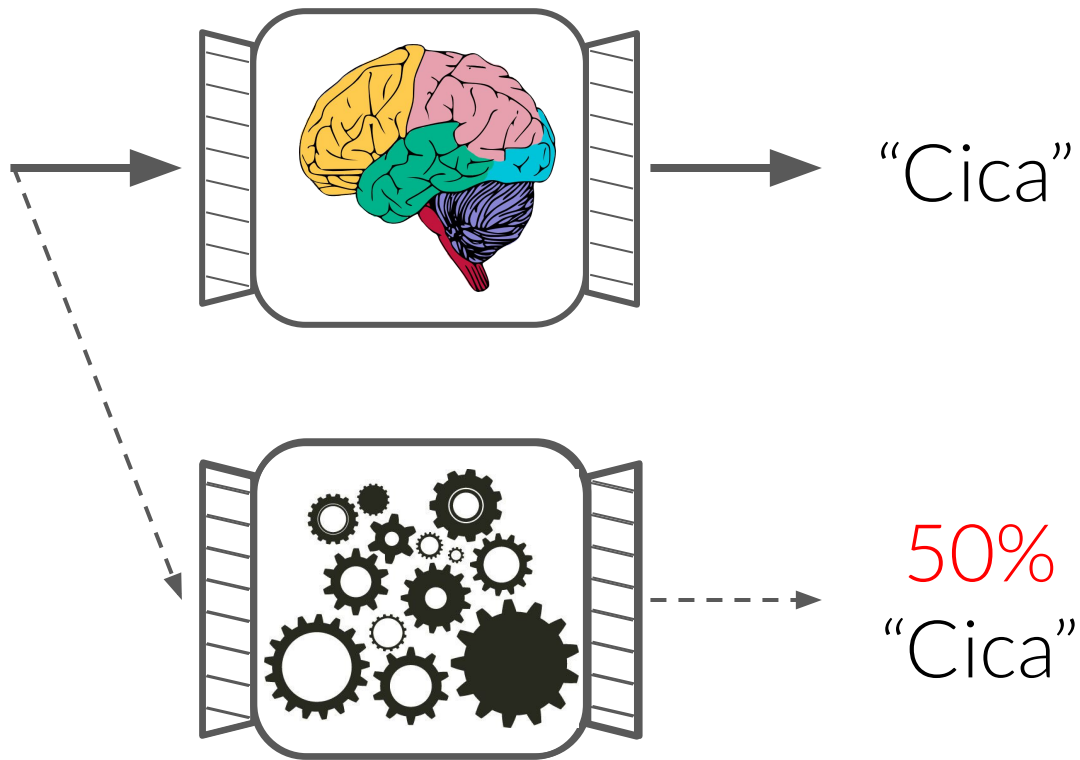
Credits: Fei Fei Li

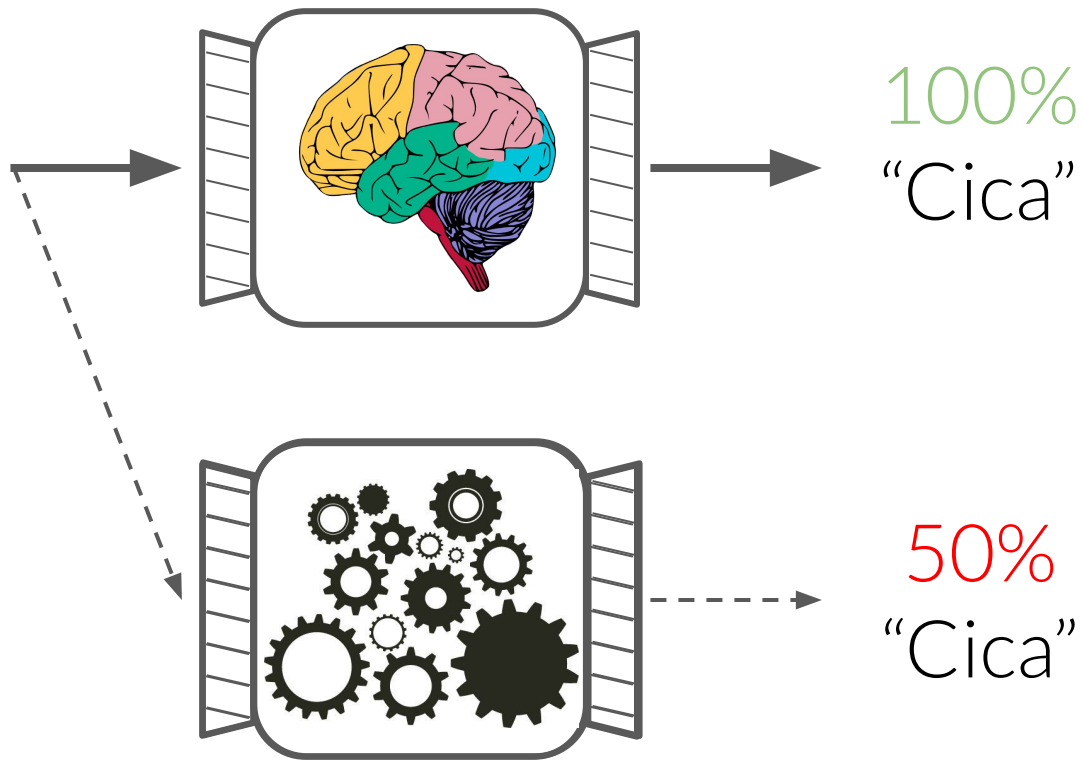
Korlátok

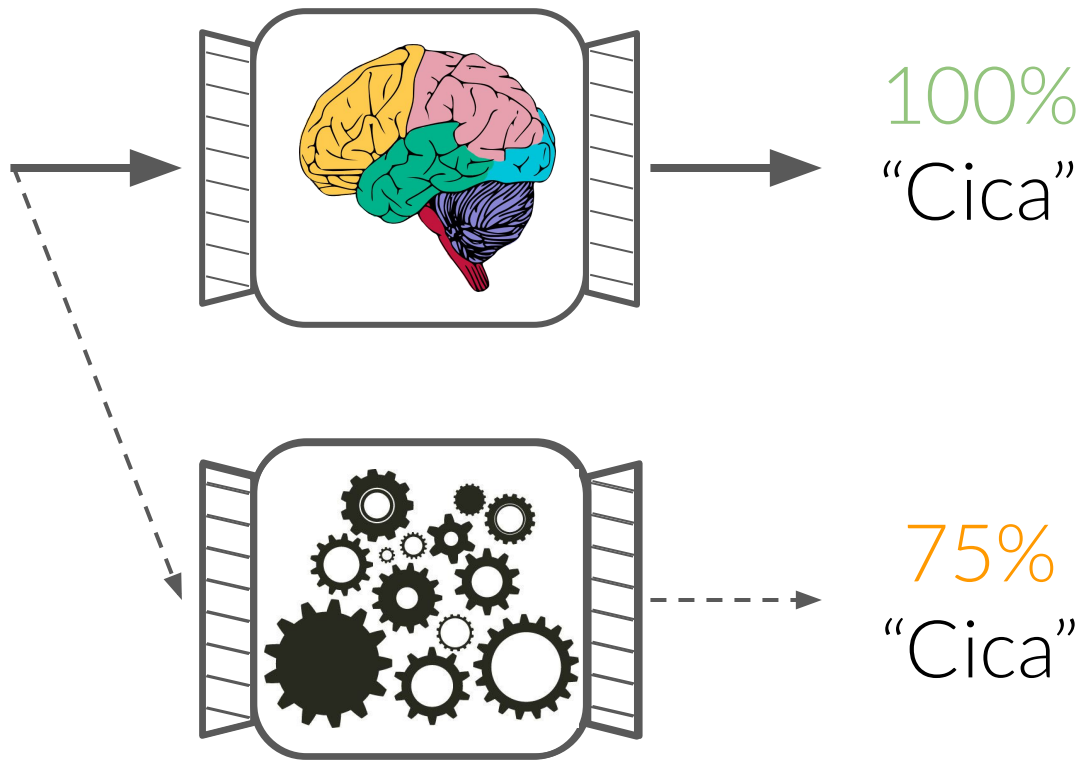


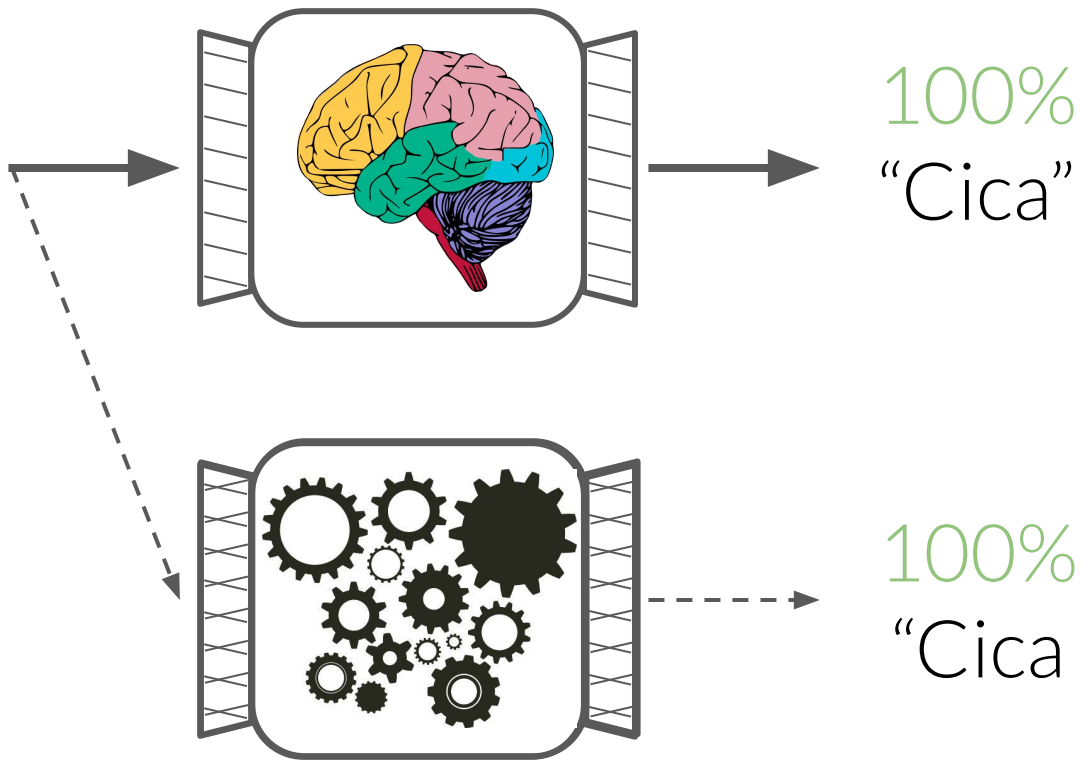


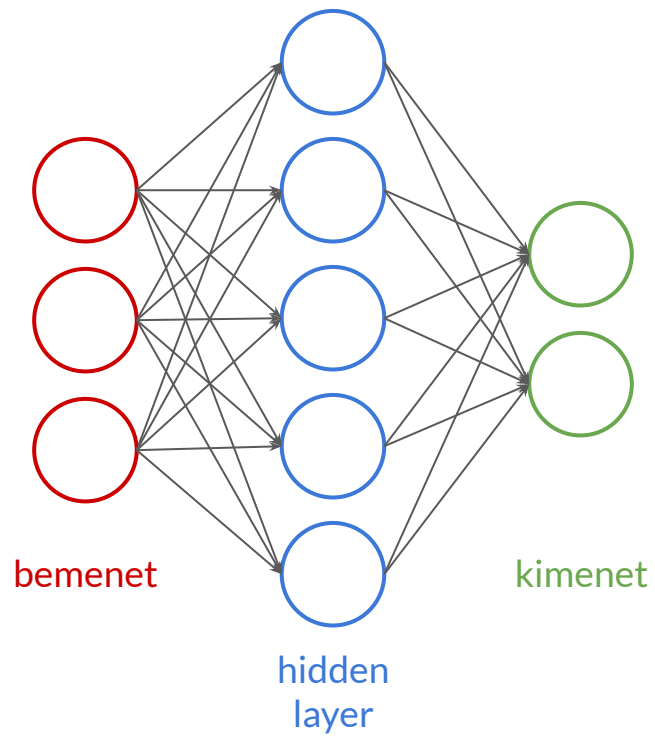
“Cica”

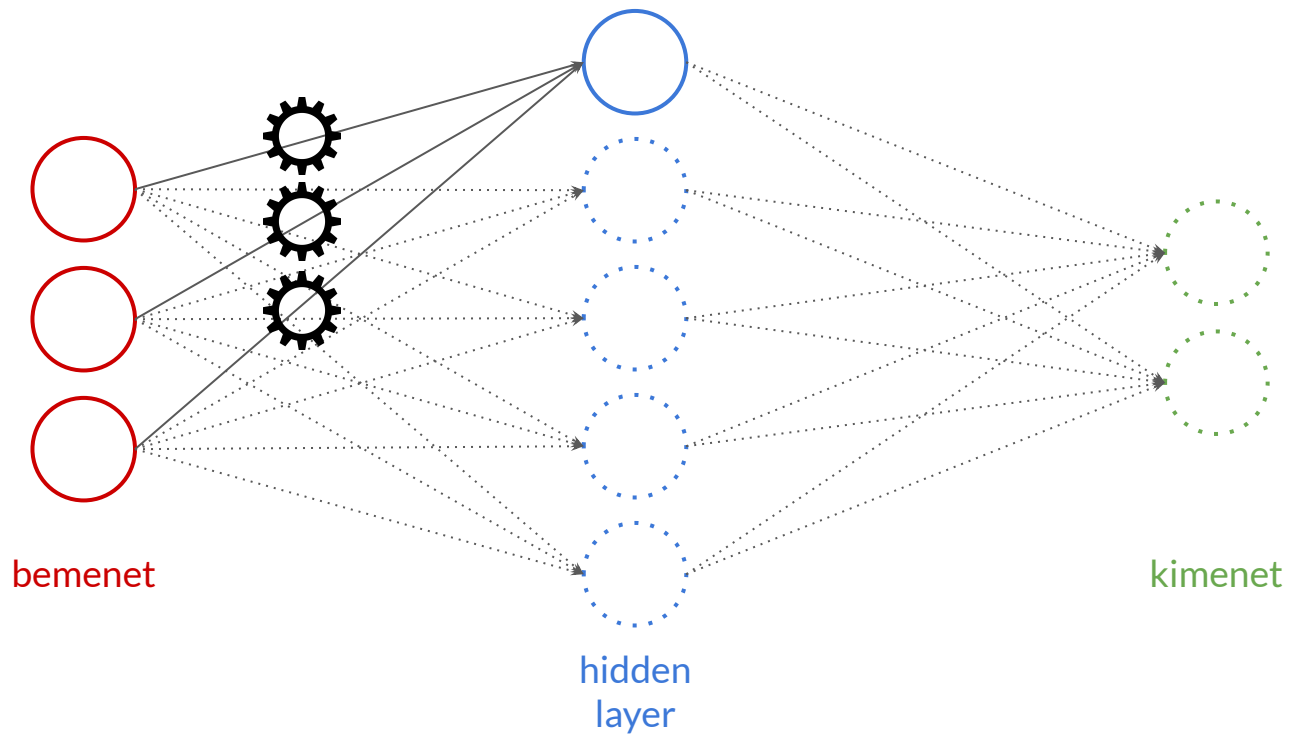


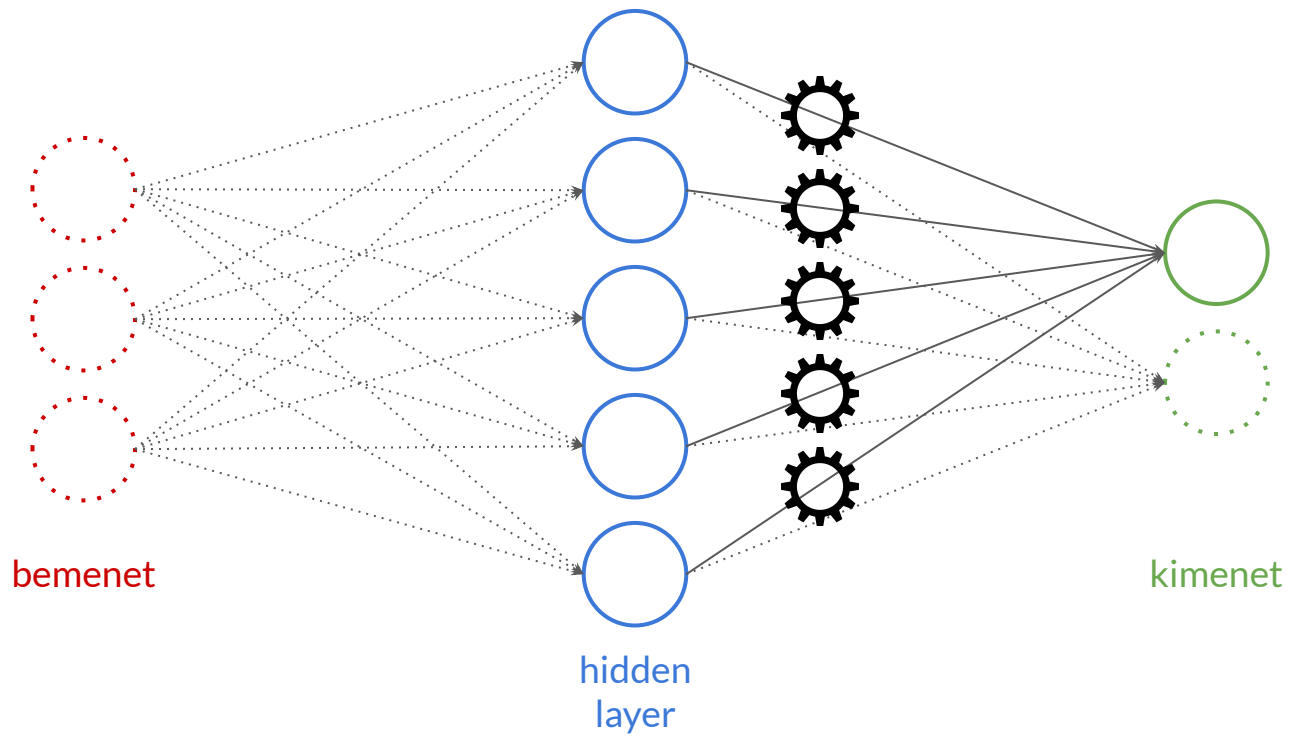






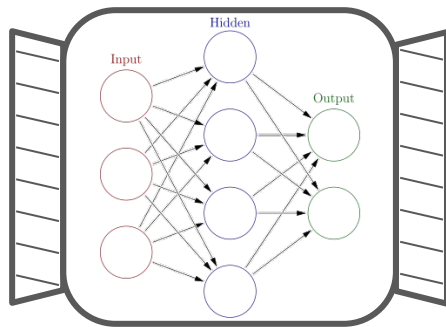
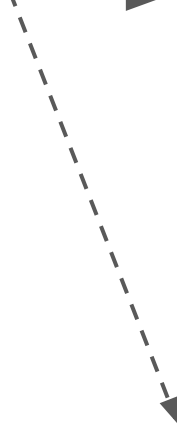




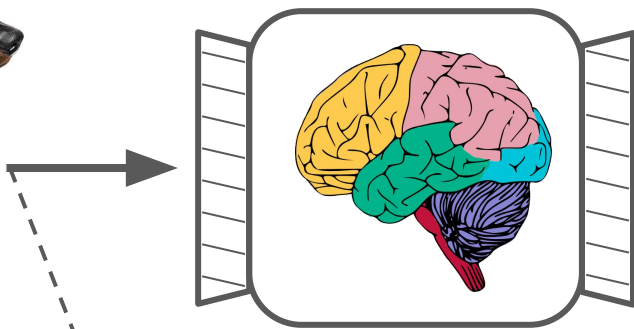




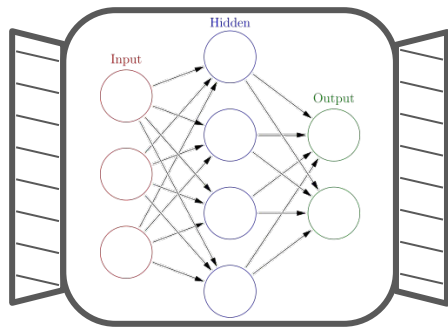
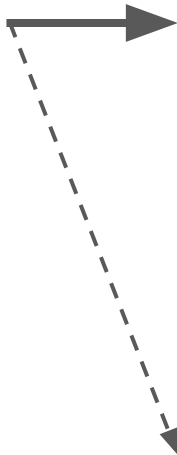
0%
“Cica”



100%
“Cica”



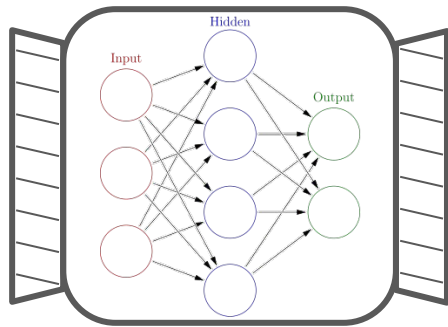
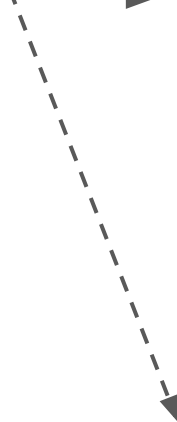
0%
“Cica”



50%
“Cica”



0%
“Cica”



0%
“Cica”



Kosztolányi Dezső

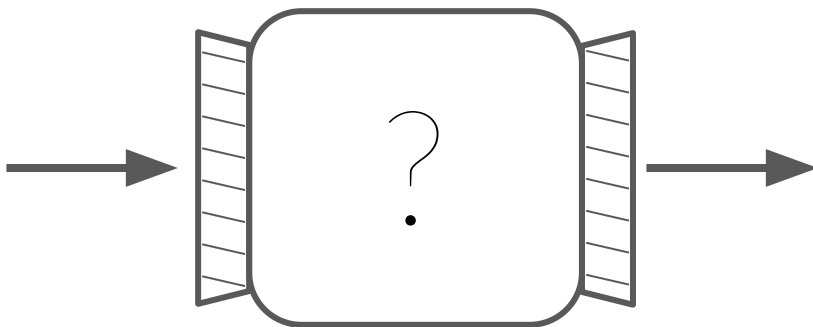
író, költő, műfordító, kritikus, esszéista, újságíró



Kosztolányi Dezső
író, költő, műfordító, **kritikus**, esszéista, újságíró

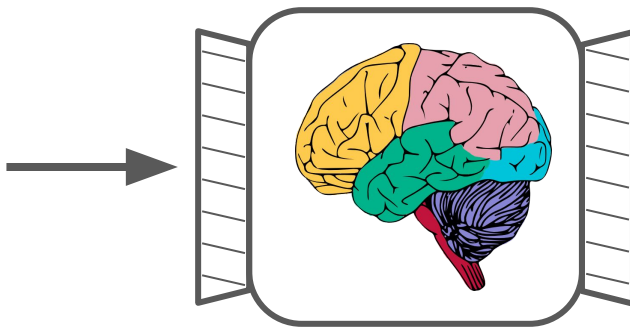
Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.

Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.



“szép”

Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.

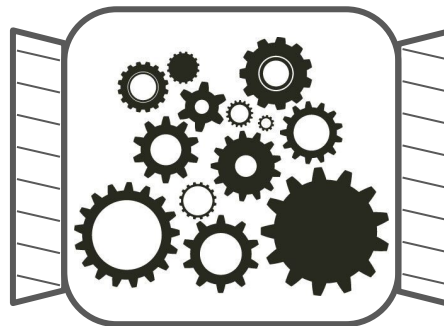


“szép”

Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.

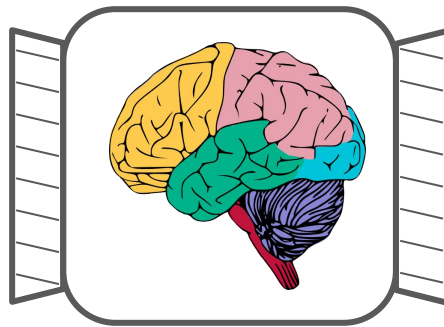


“szép”

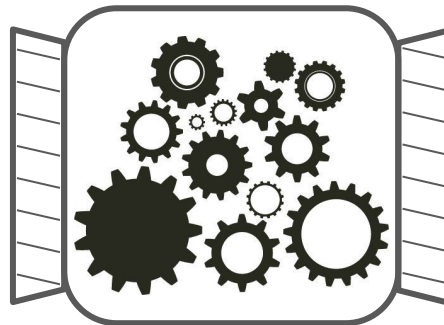


50%
“szép”

Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.



“szép”

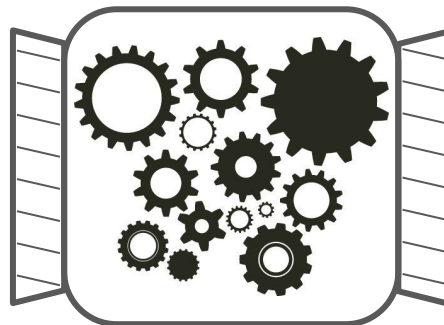


75%
“szép”

Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.



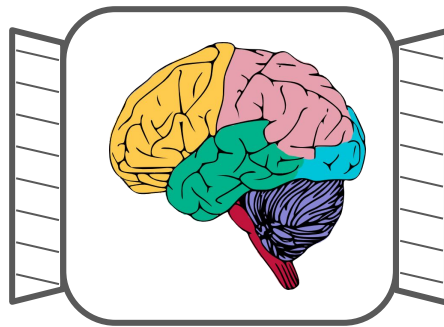
“szép”



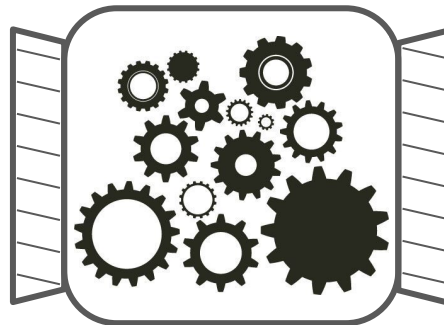
100%
“szép”

Legkülömb ember, aki bátor
S csak egy külömb van, aki: bátrabb.

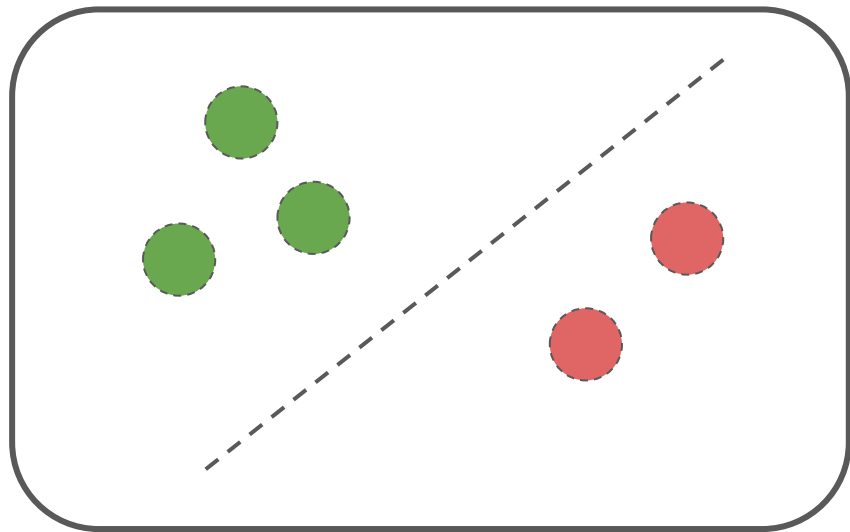
Legkülömb ember, aki bátor
S csak egy külömb van, aki: bátrabb.



“szép”



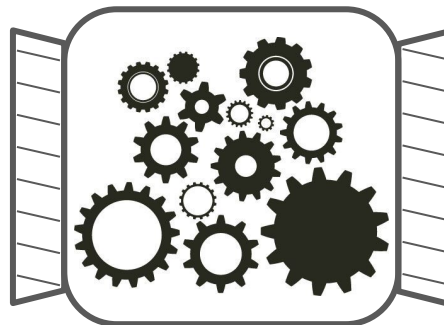
100%
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Legkülömb ember, aki bátor
S csak egy külömb van, aki: bátrabb.

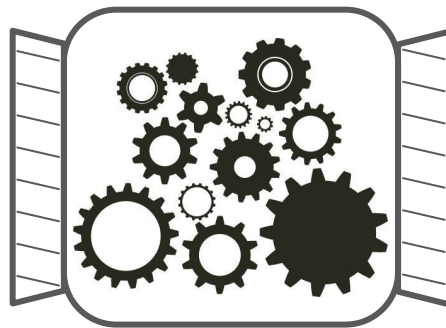


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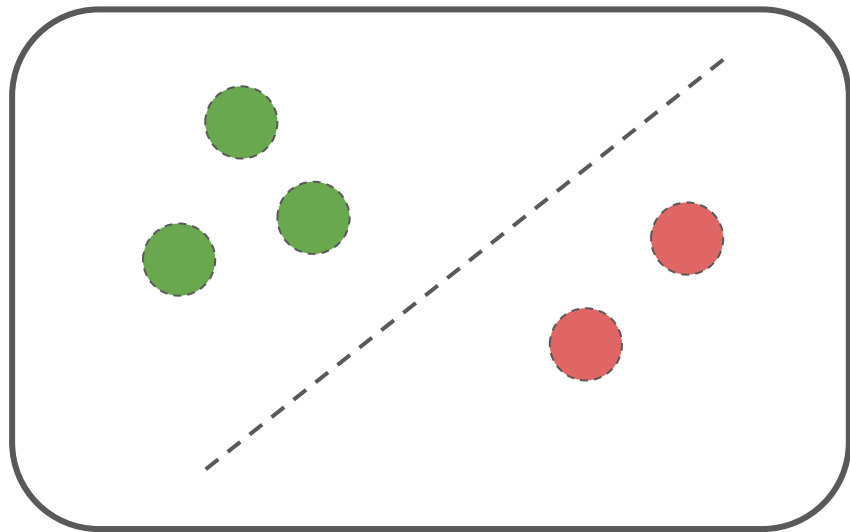


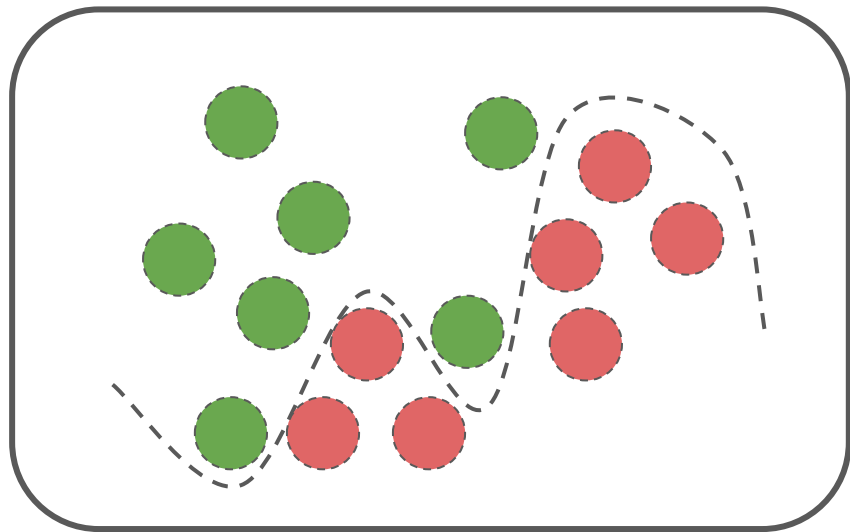
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“szép”

Legkülömb ember, aki bátor
S csak egy külömb van, aki: bátrabb.

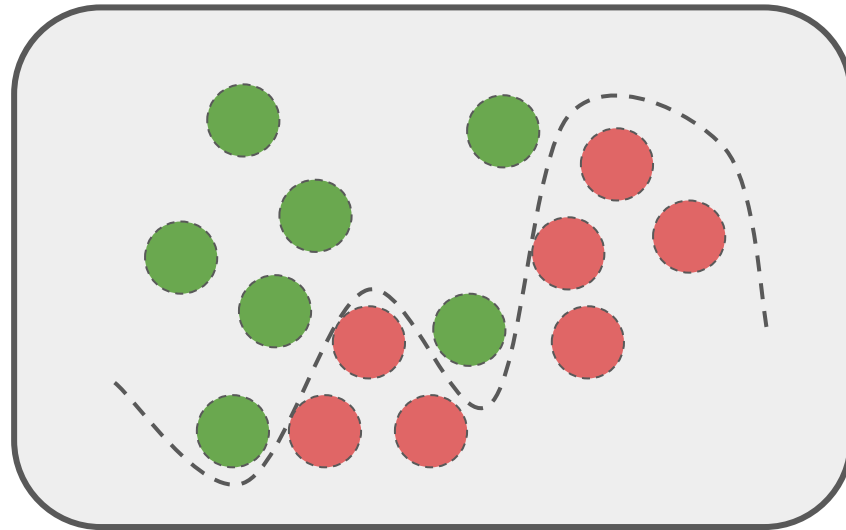


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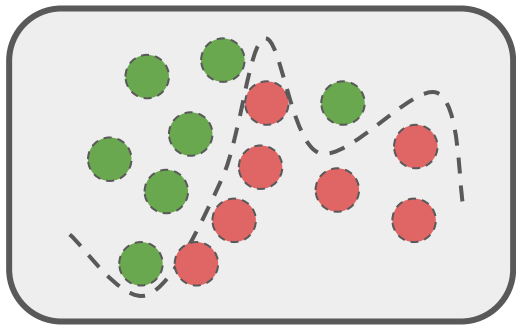




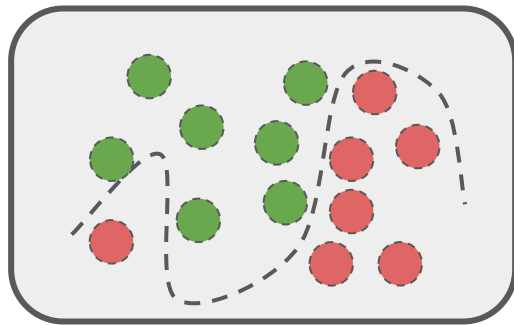
Csabi



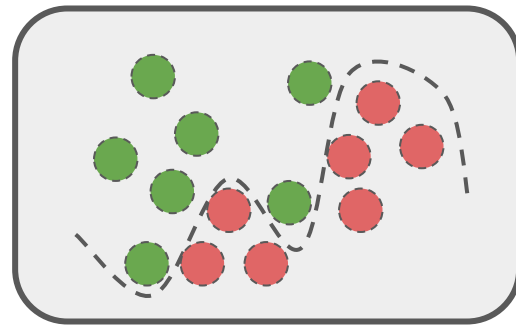
Aladár



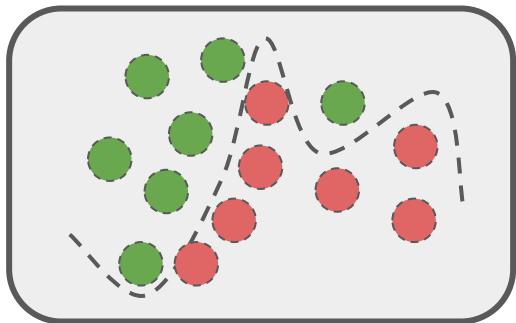
Béla



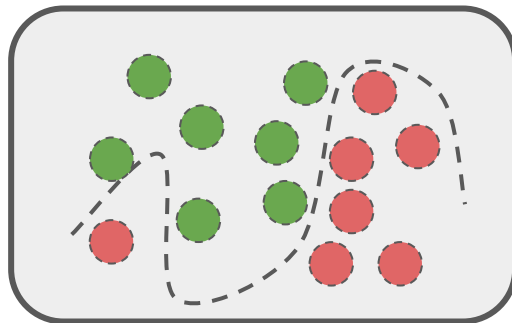
Cecil



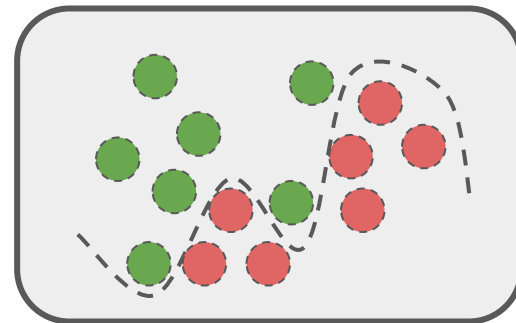
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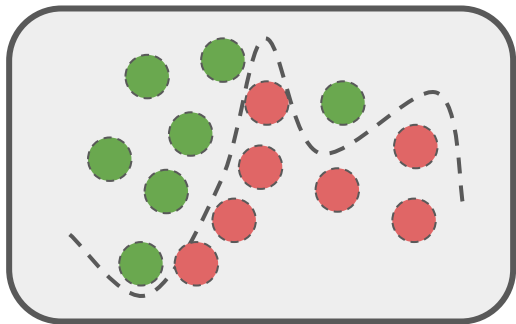
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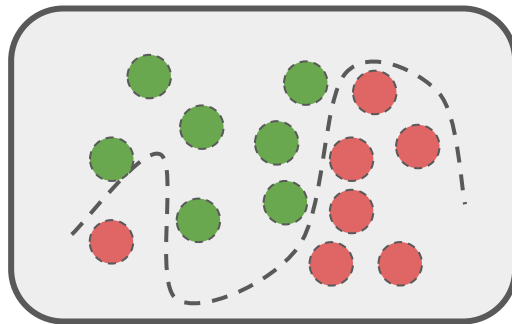
Cecil



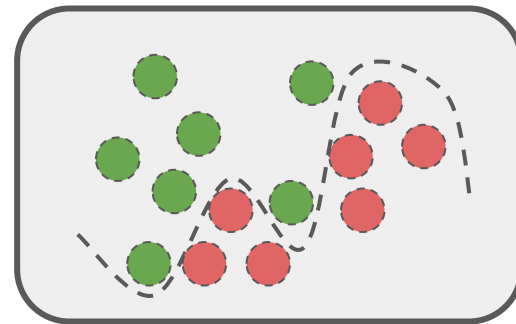
Döme

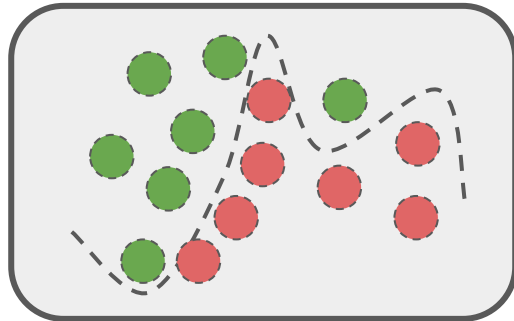
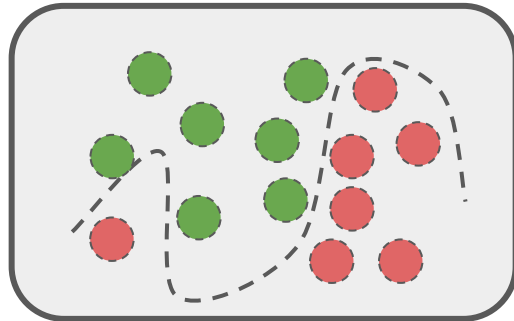
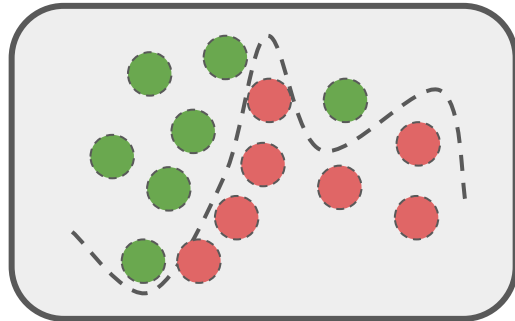
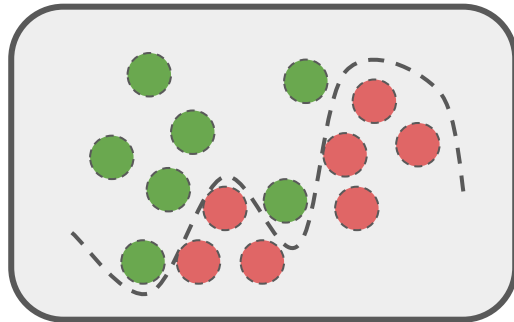
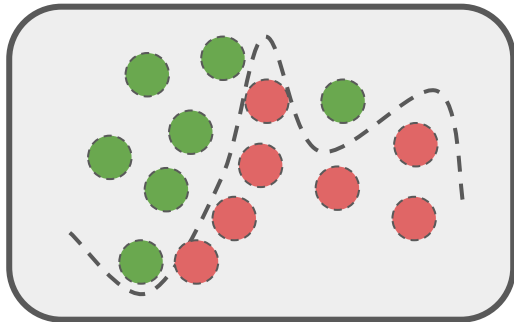
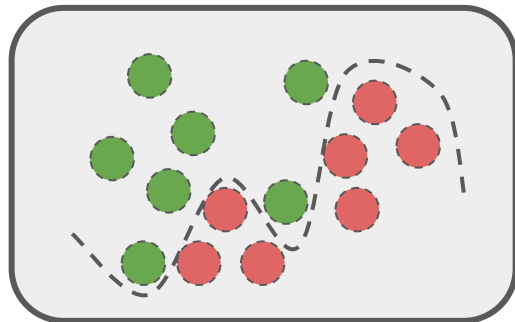
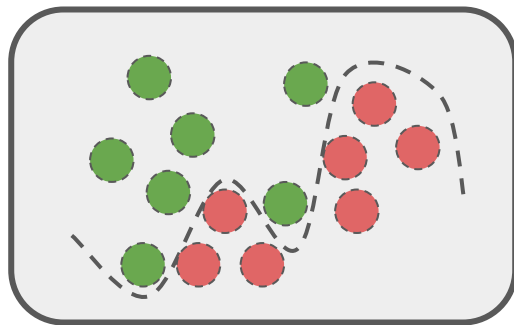
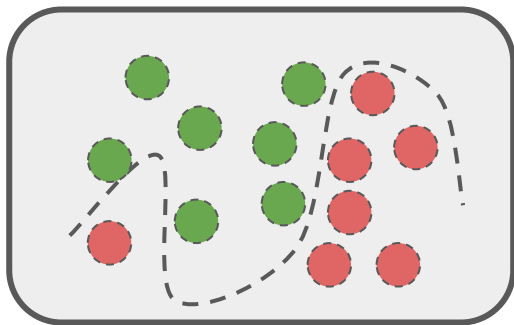
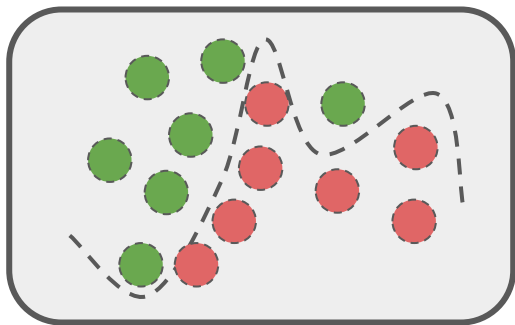


Elemér

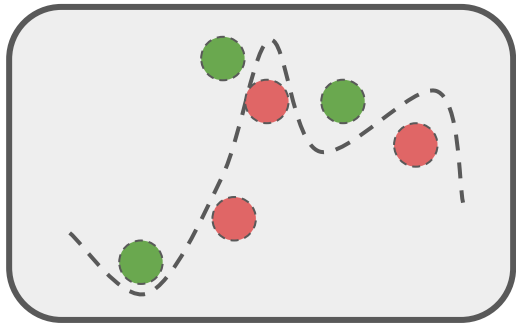


Feri

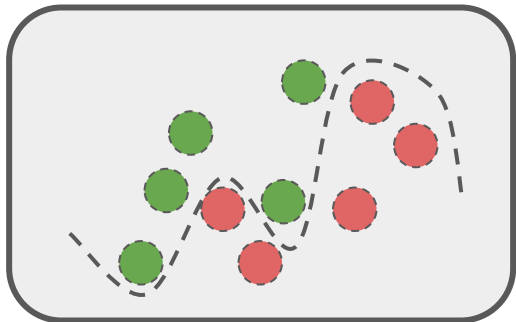




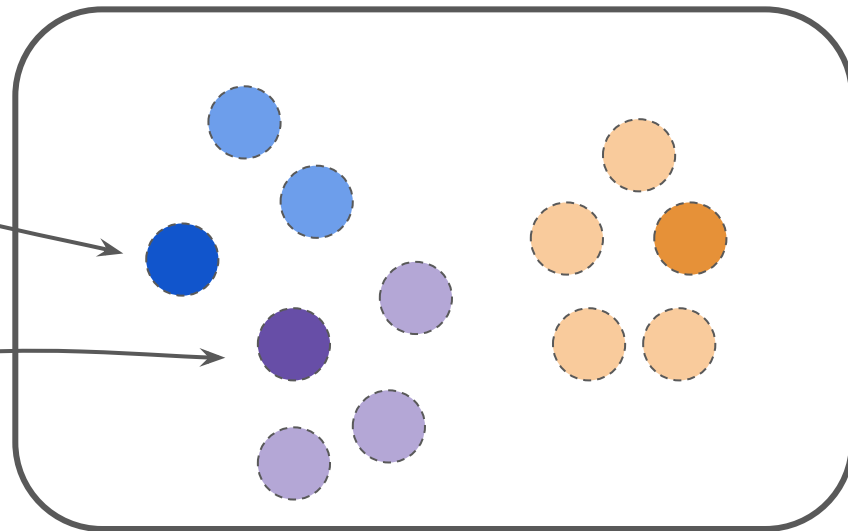
Krisz



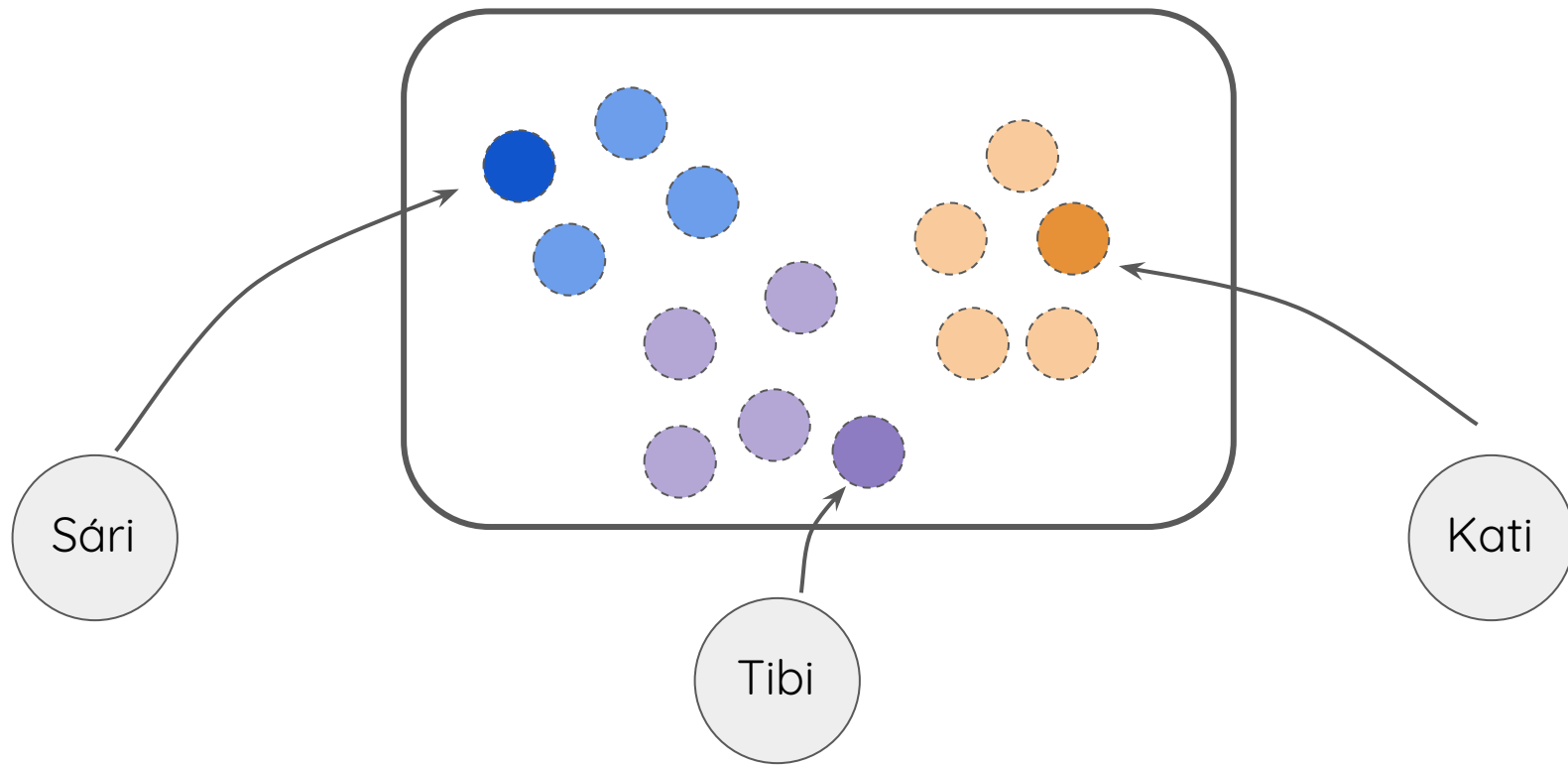
Lilla



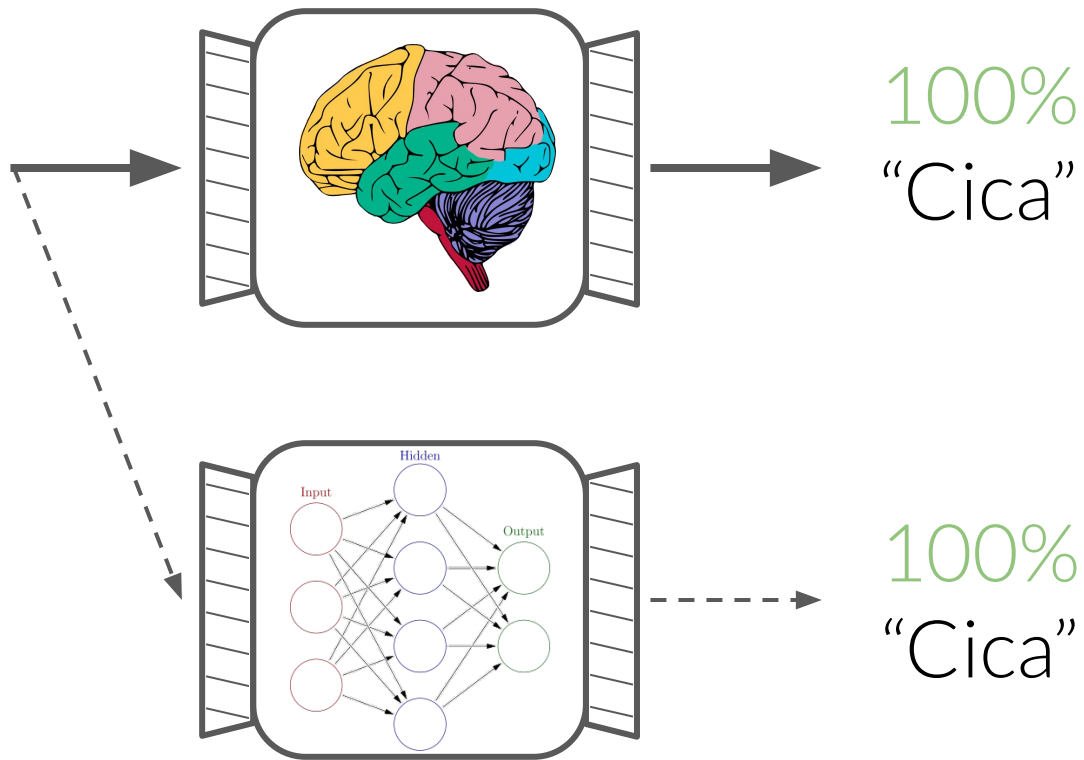
Cluster



Cluster



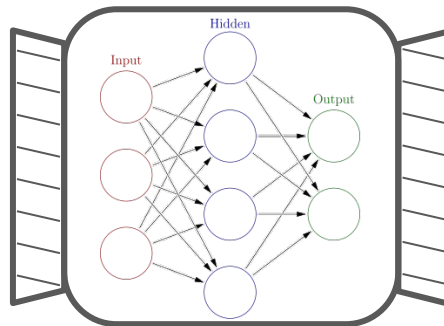
Szövegfeldolgozás?



Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.



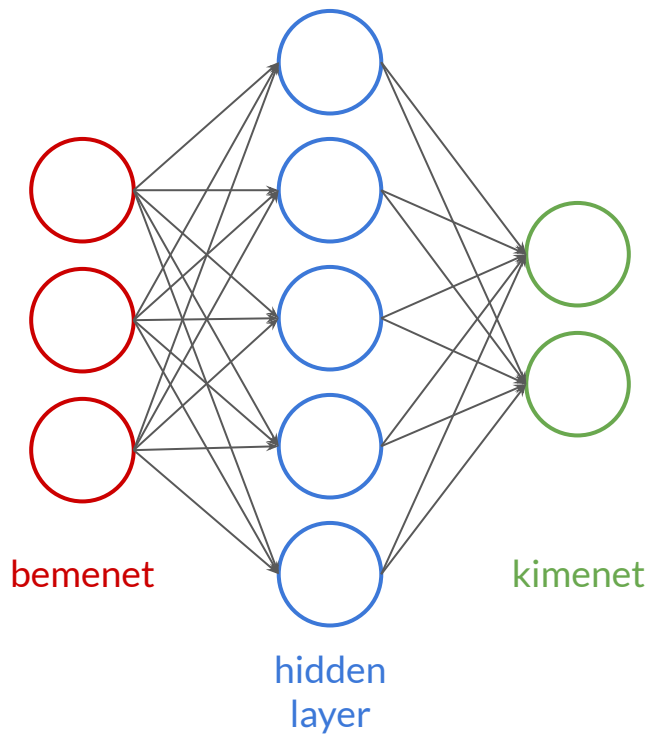
“szép”



???

Gondolkodom, tehát vagyok

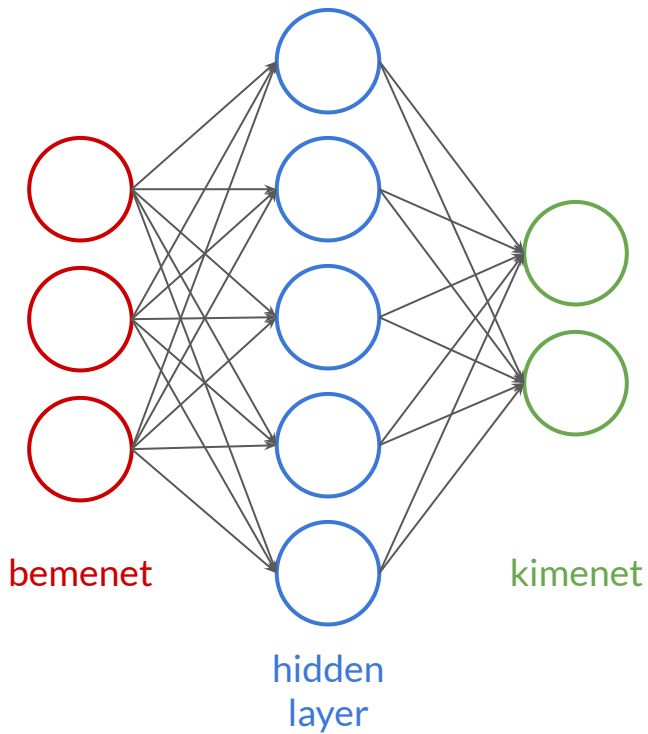
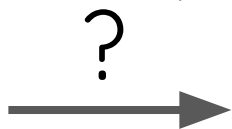
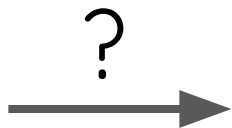
Gondolkodom,
tehát
vagyok



Gondolkodom,

tehát

vagyok



Gondolkodom,

tehát

vagyok

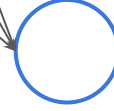
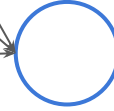
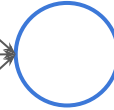
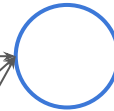
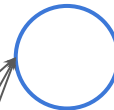


1

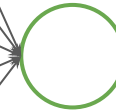
2

3

bemenet



hidden
layer



kimenet

Gondolkodom,

tehát

vagyok

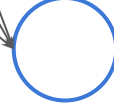
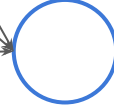
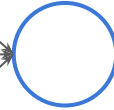
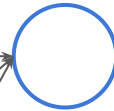
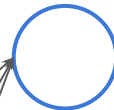


42

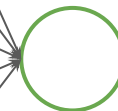
23

69

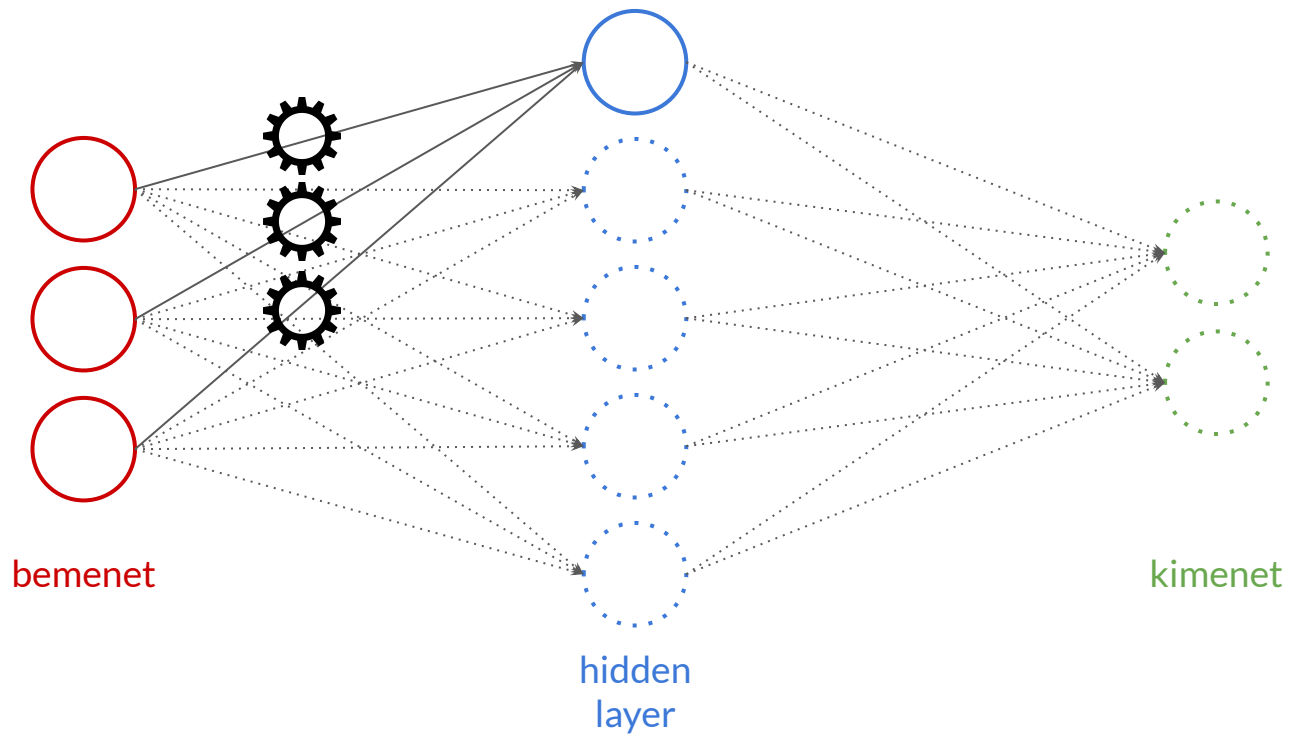
bemenet

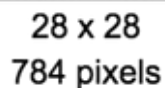


hidden
layer



kimenet





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Gondolkodom,

tehát

vagyok

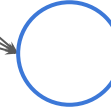
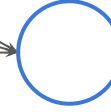
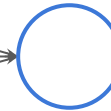
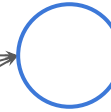
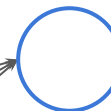


42

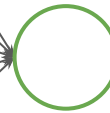
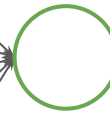
23

69

bemenet



hidden
layer



kimenet

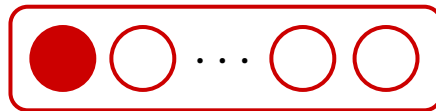
sorszám

sorszám

1. Szó



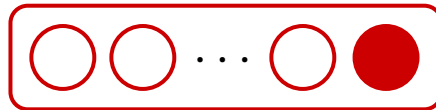
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2. Szó



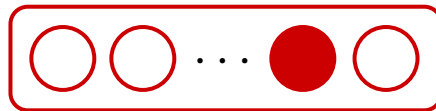
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3. Szó



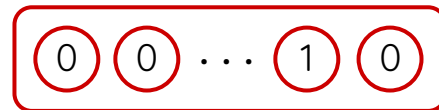
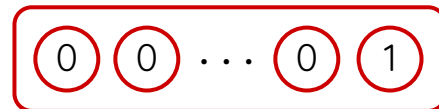
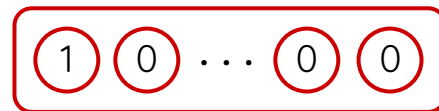
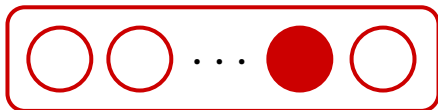
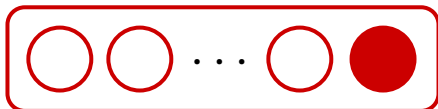
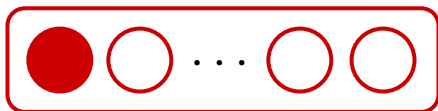
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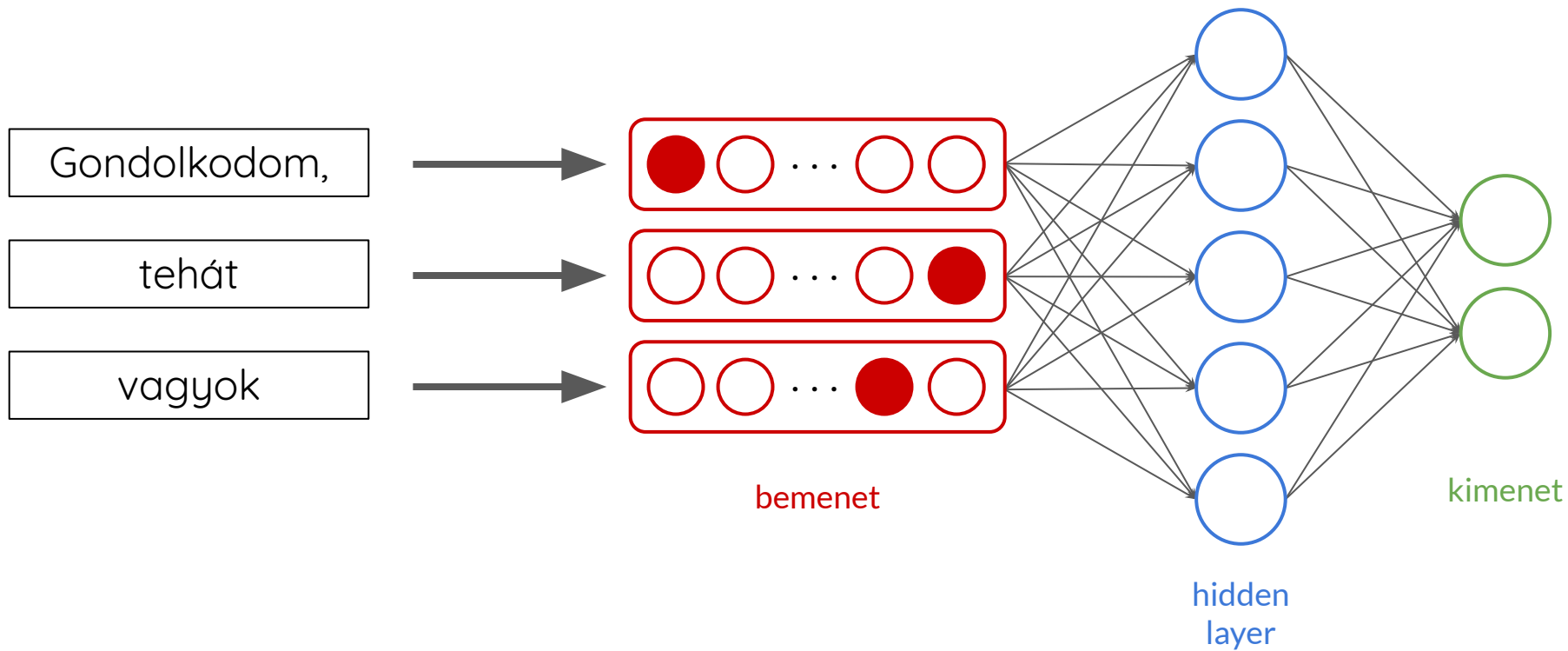
a szövegben

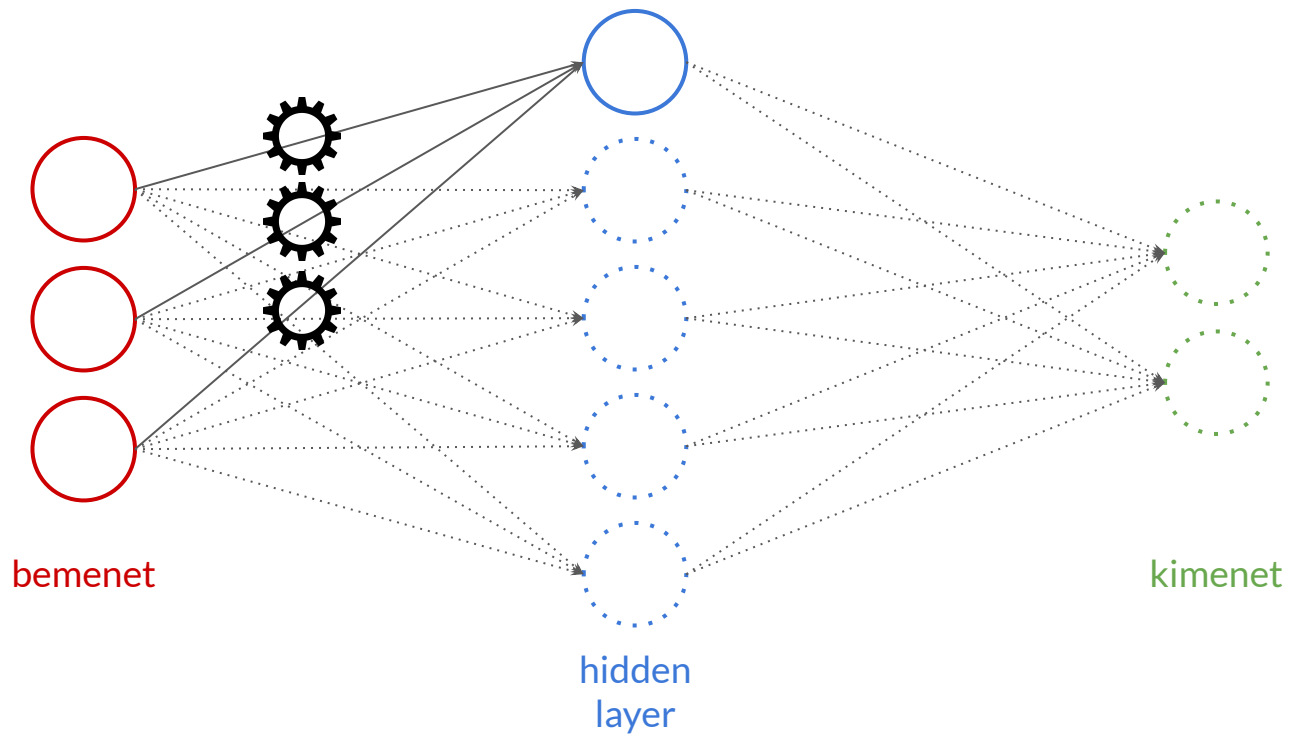
a szótárban

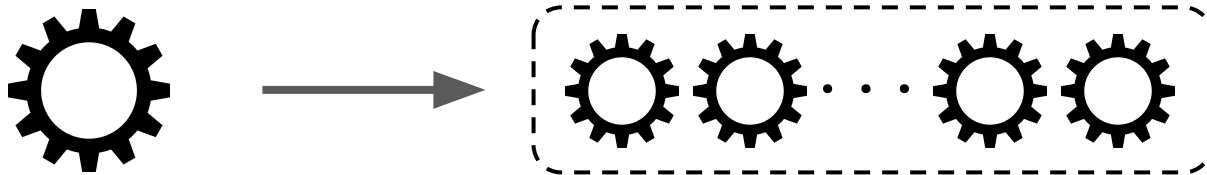
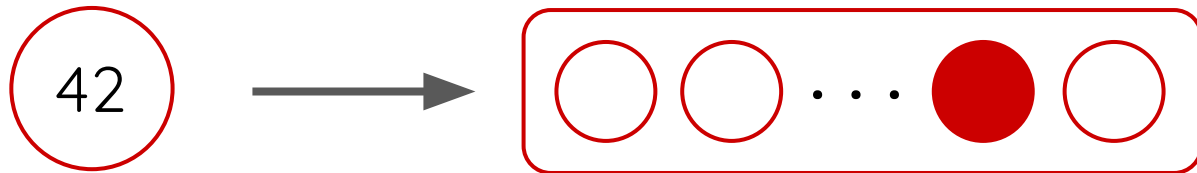
feldolgozható
bemenet

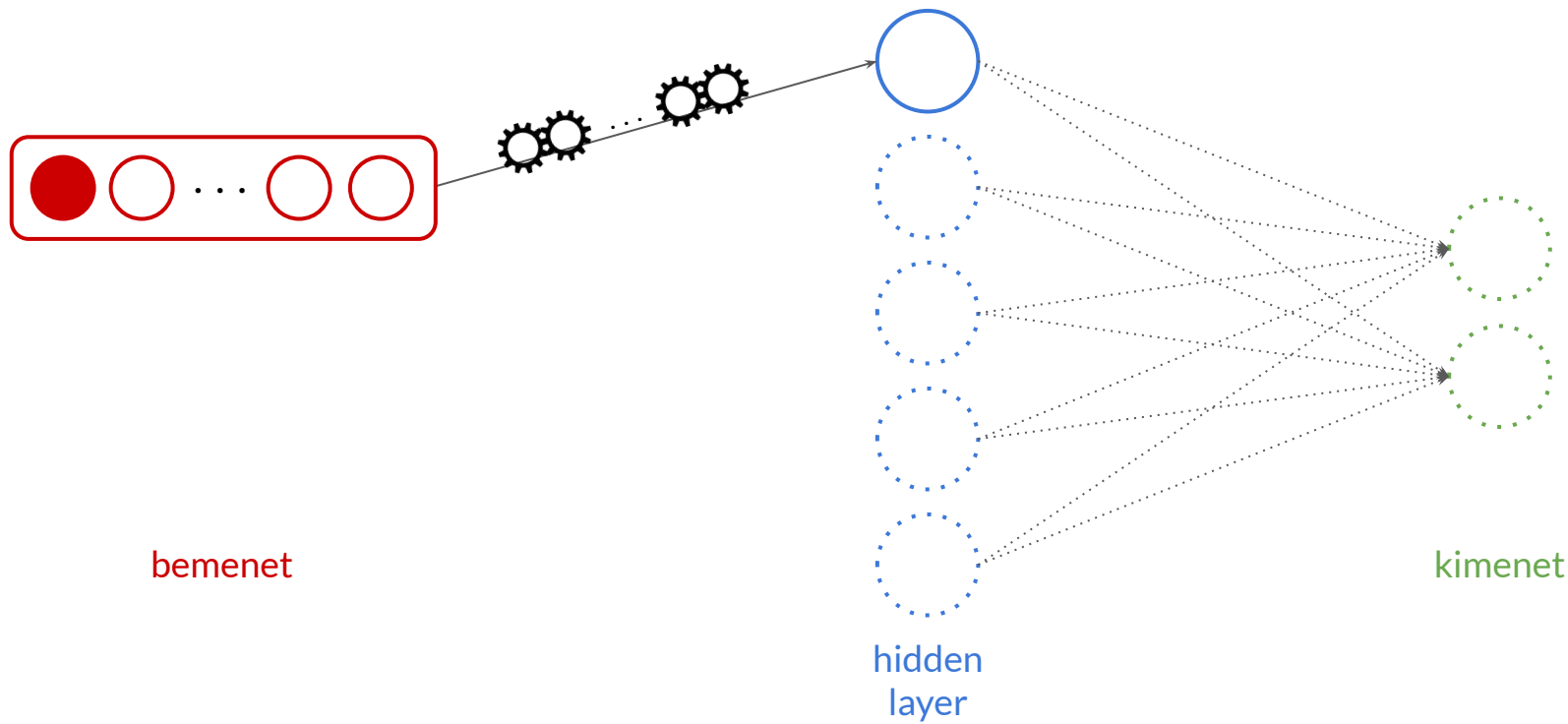


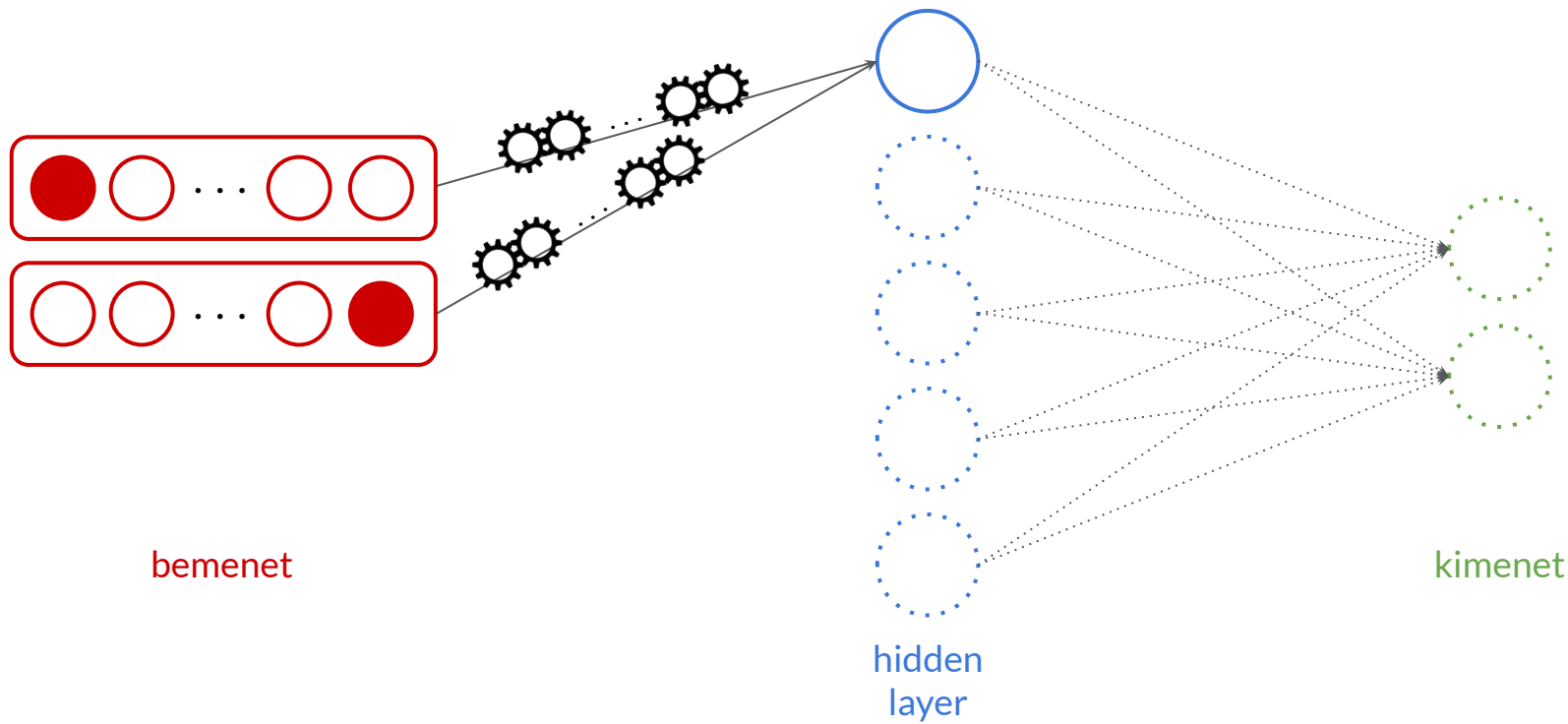
feldolgozható
bemenet

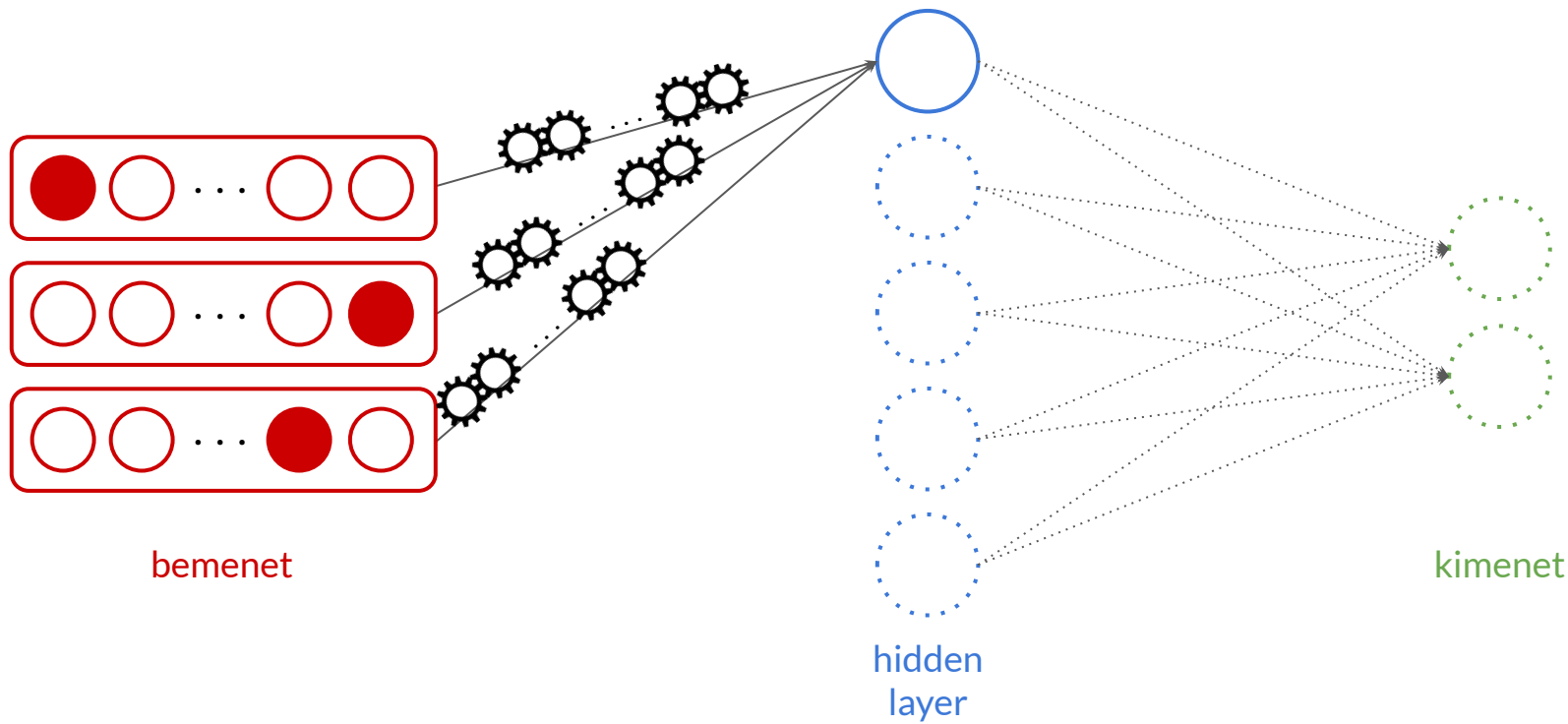


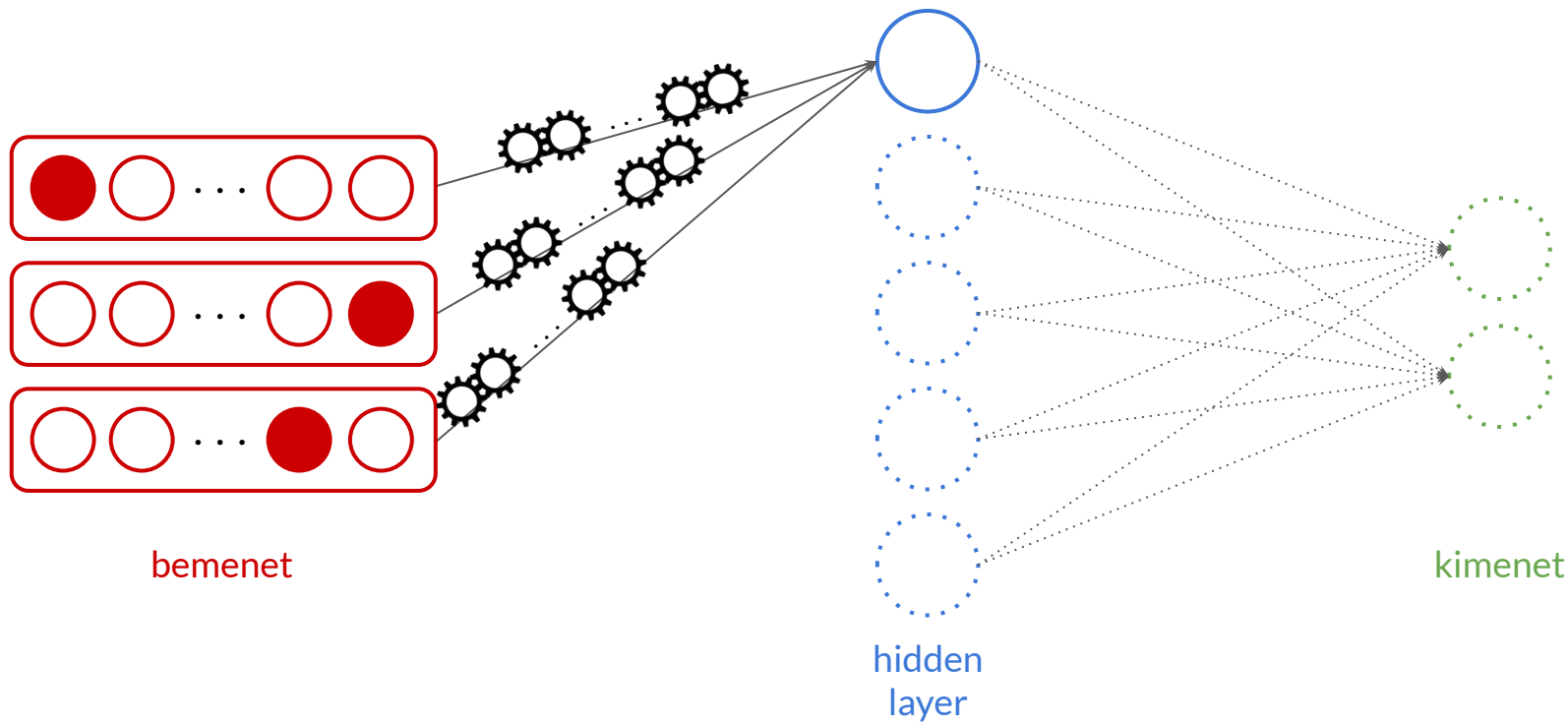


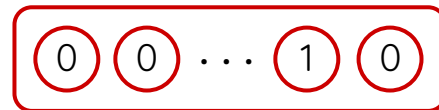
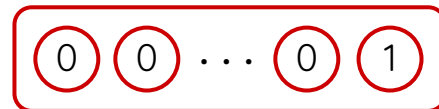
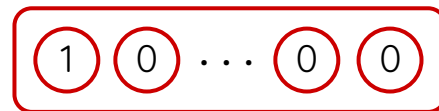
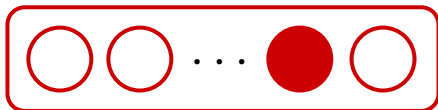
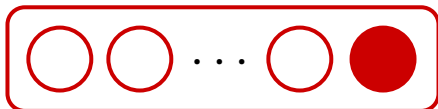
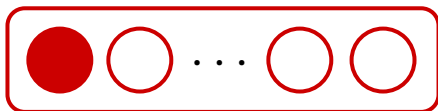




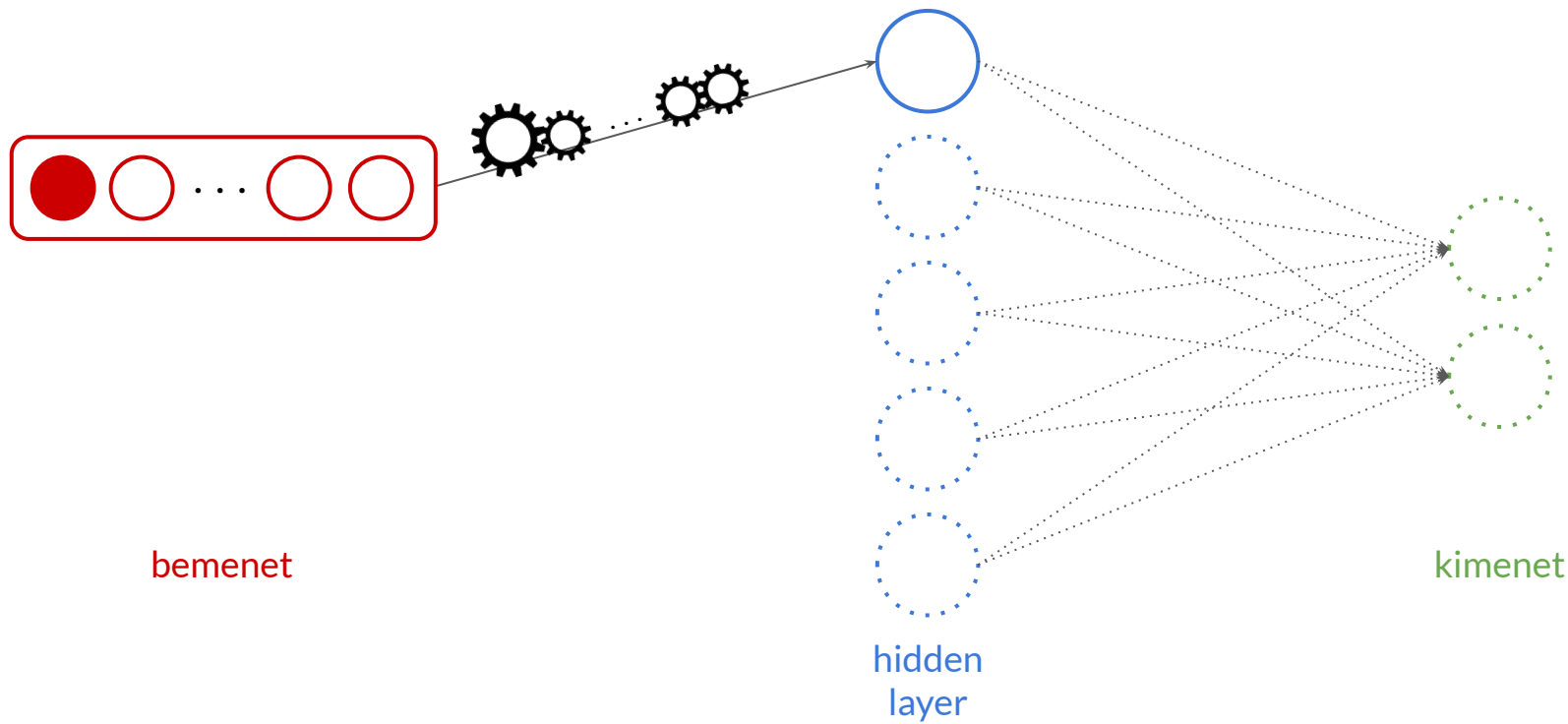




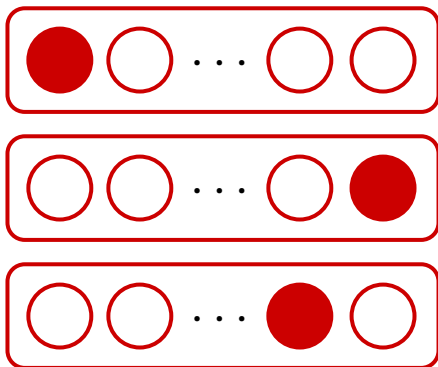




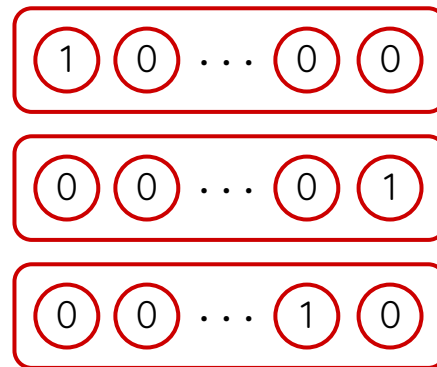
feldolgozható
bemenet



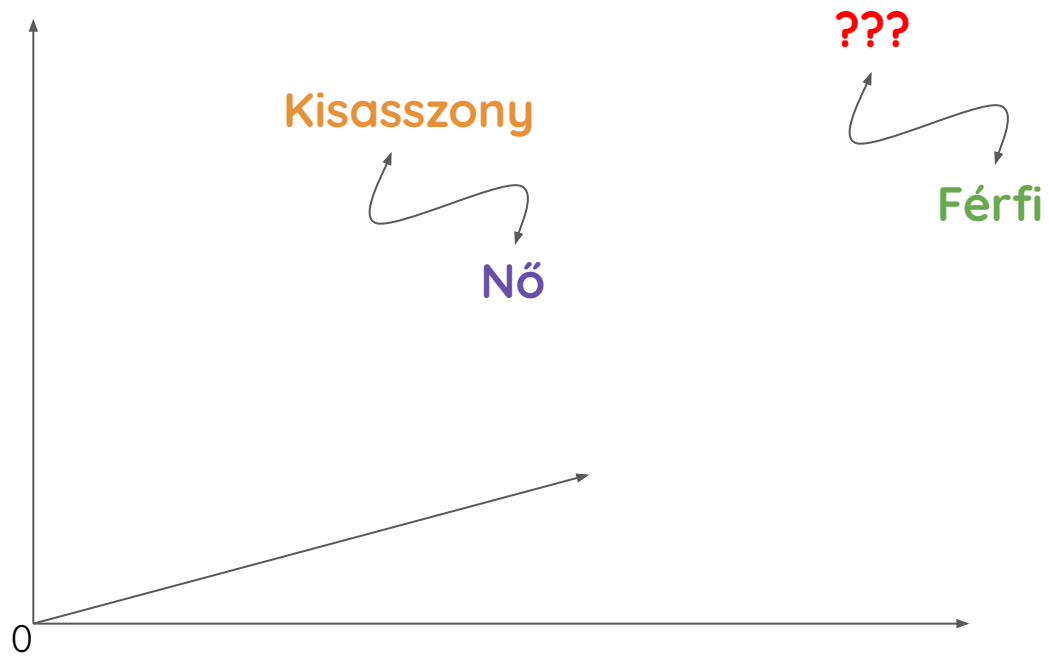
Jel

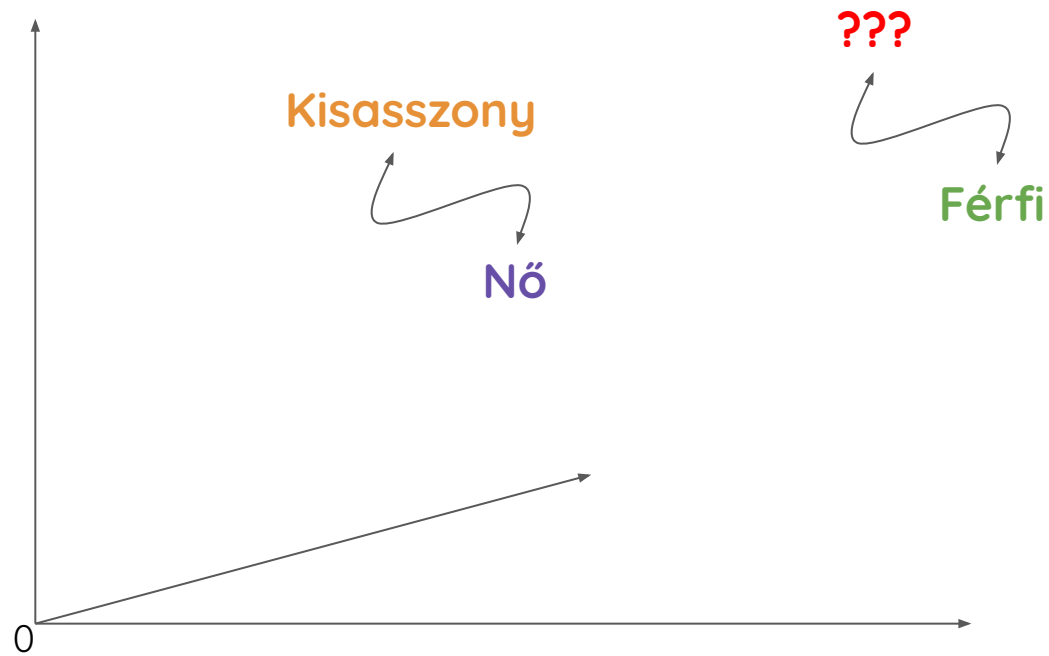


Kód

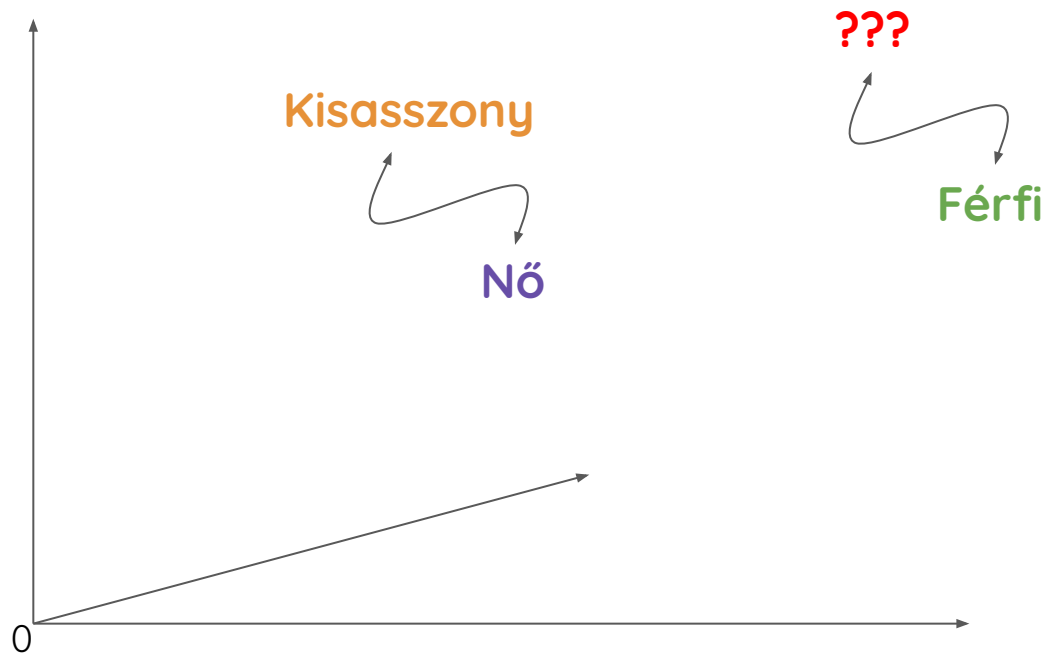


feldolgozható
bemenet

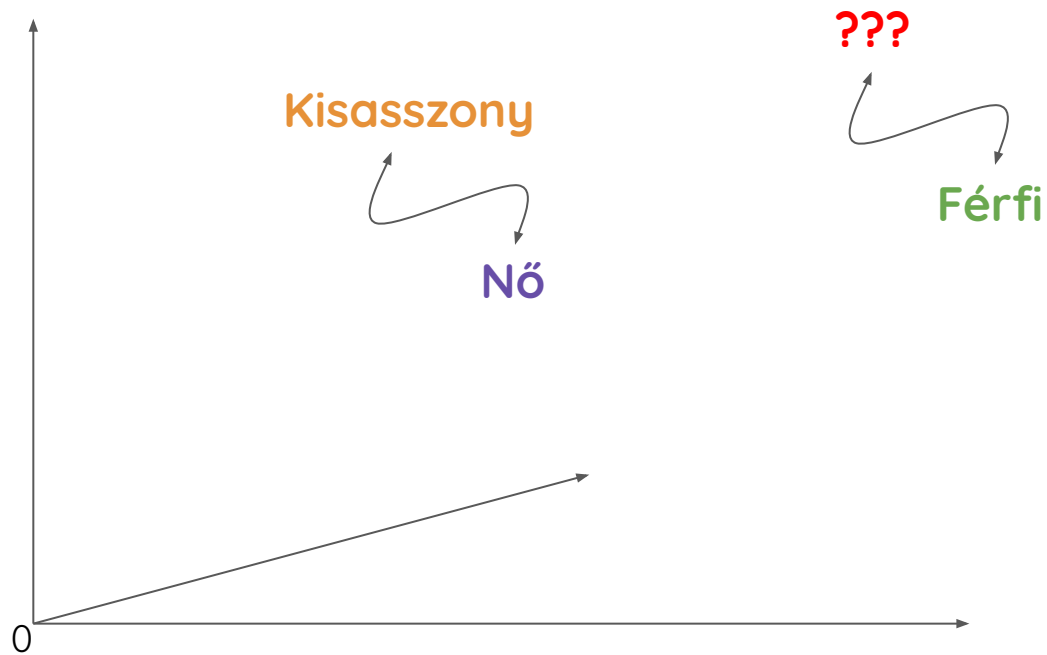




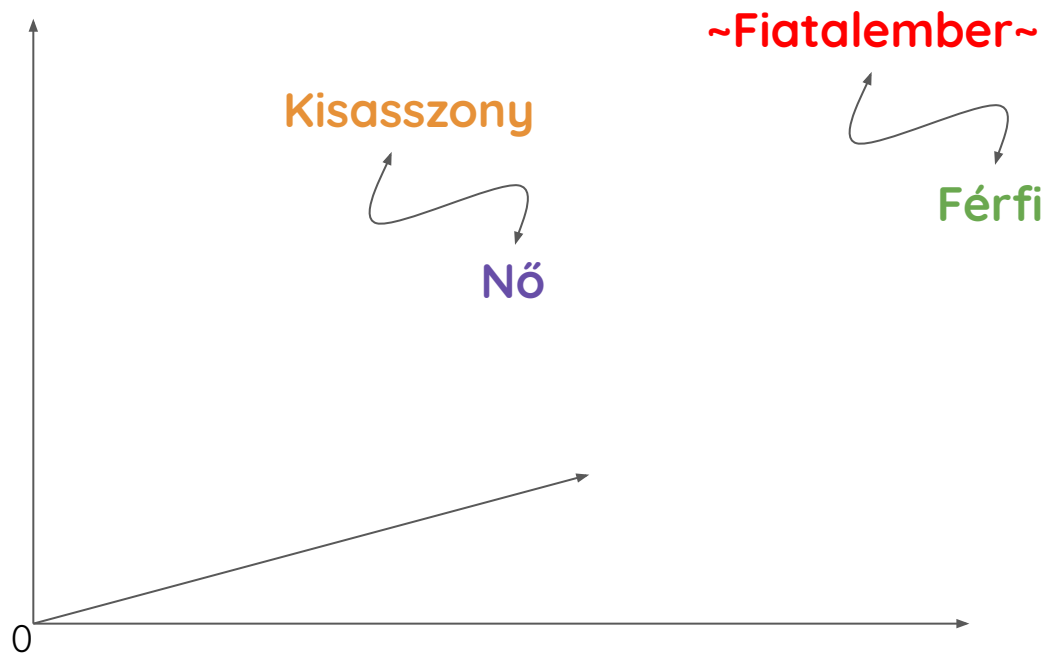
“Kisasszony” - “Nő”



(“Kisasszony” - “Nő”) + “Férfi”



$$(\text{"Kisasszony"} - \text{"Nő"}) + \text{"Férfi"} = ???$$



Kisasszony

-

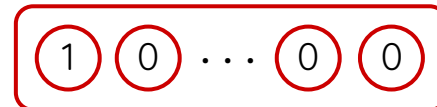
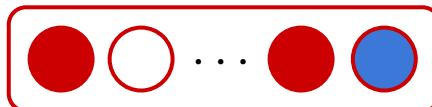
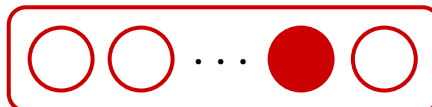
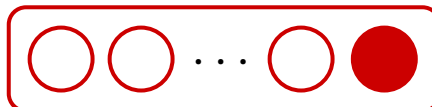
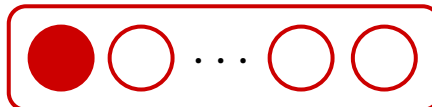
Nő

+

Férfi

=

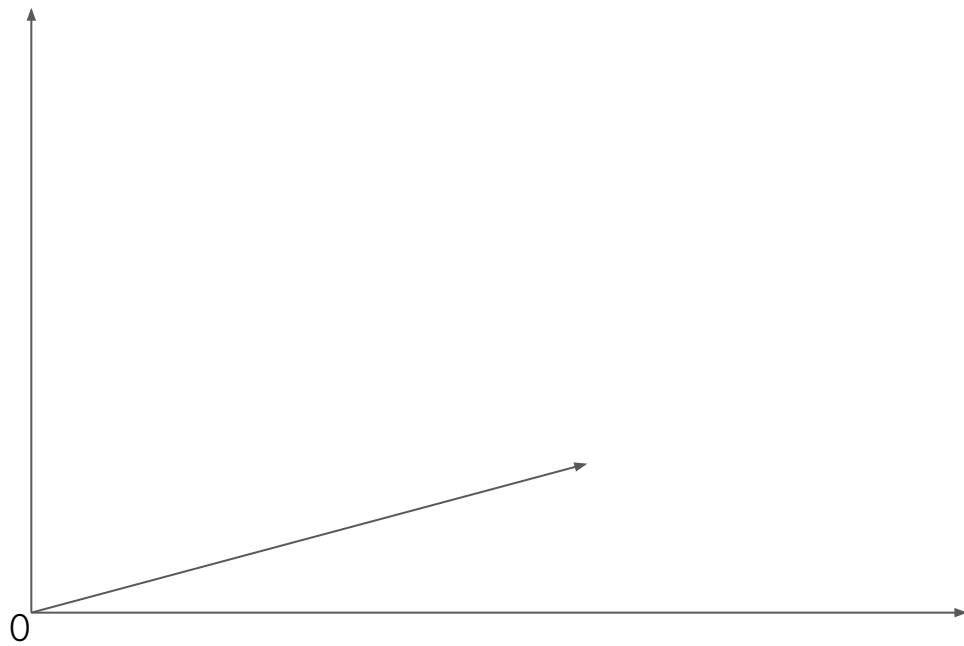
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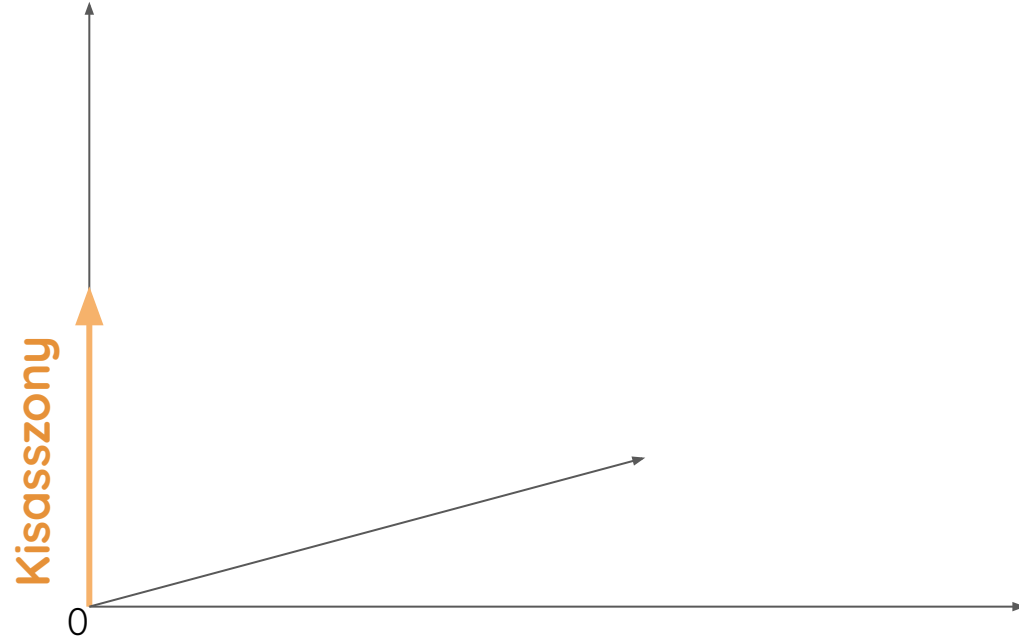


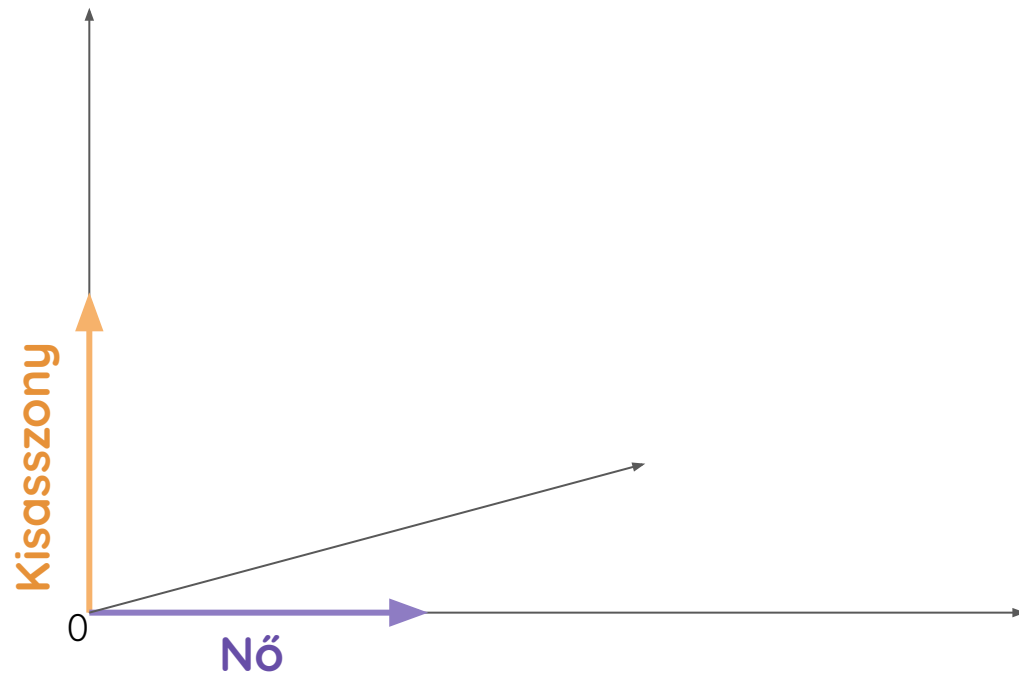
Szó

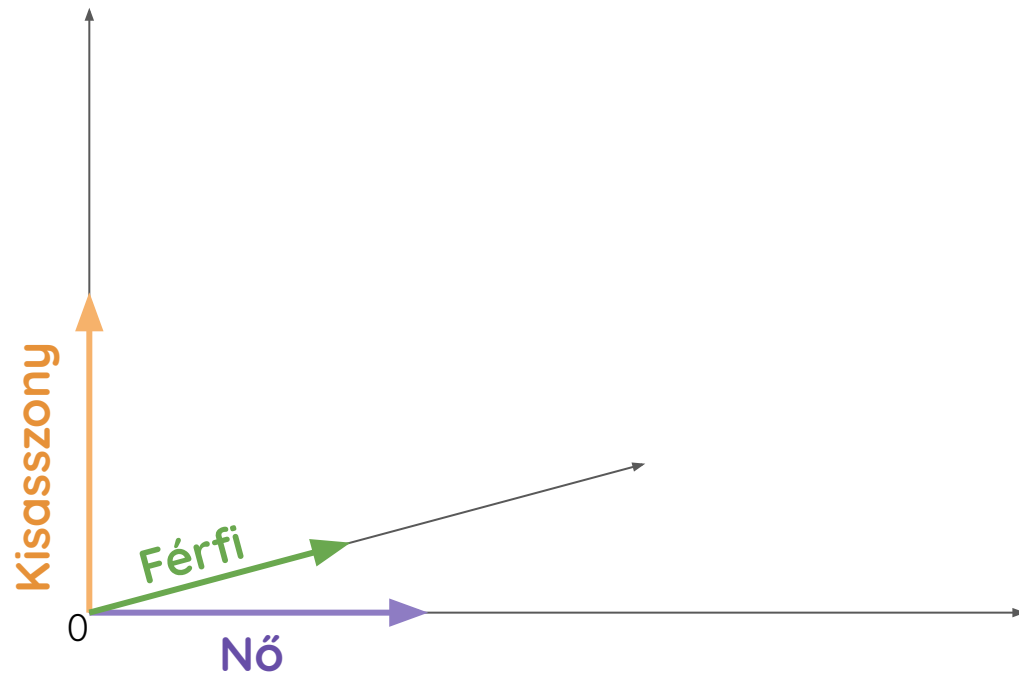
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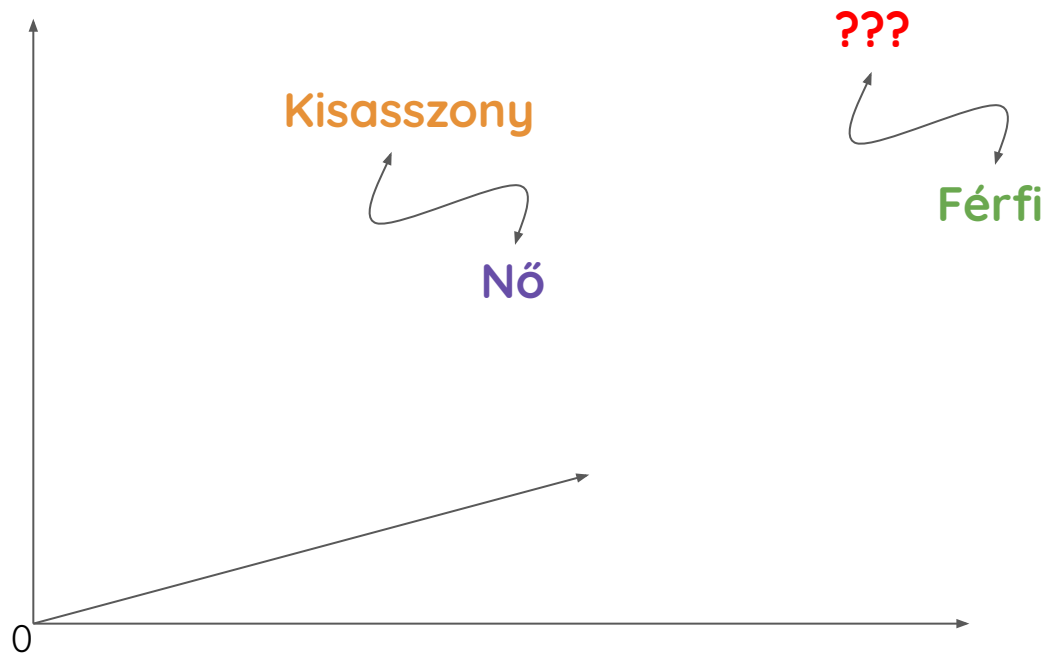
Kód

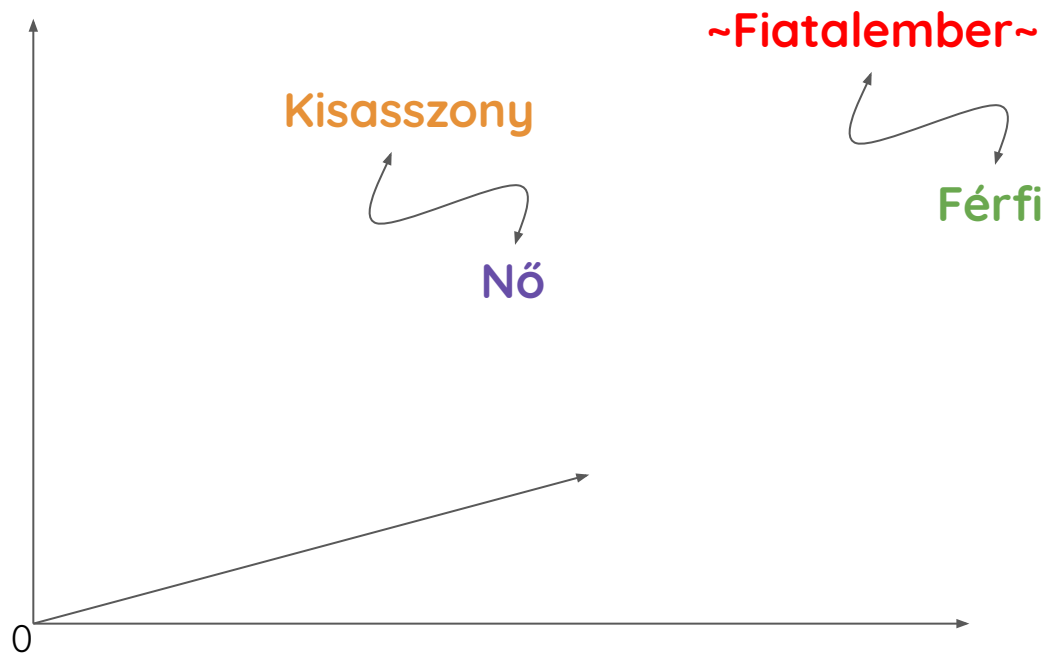












Ezt

hogy

képzelte

kisasszony

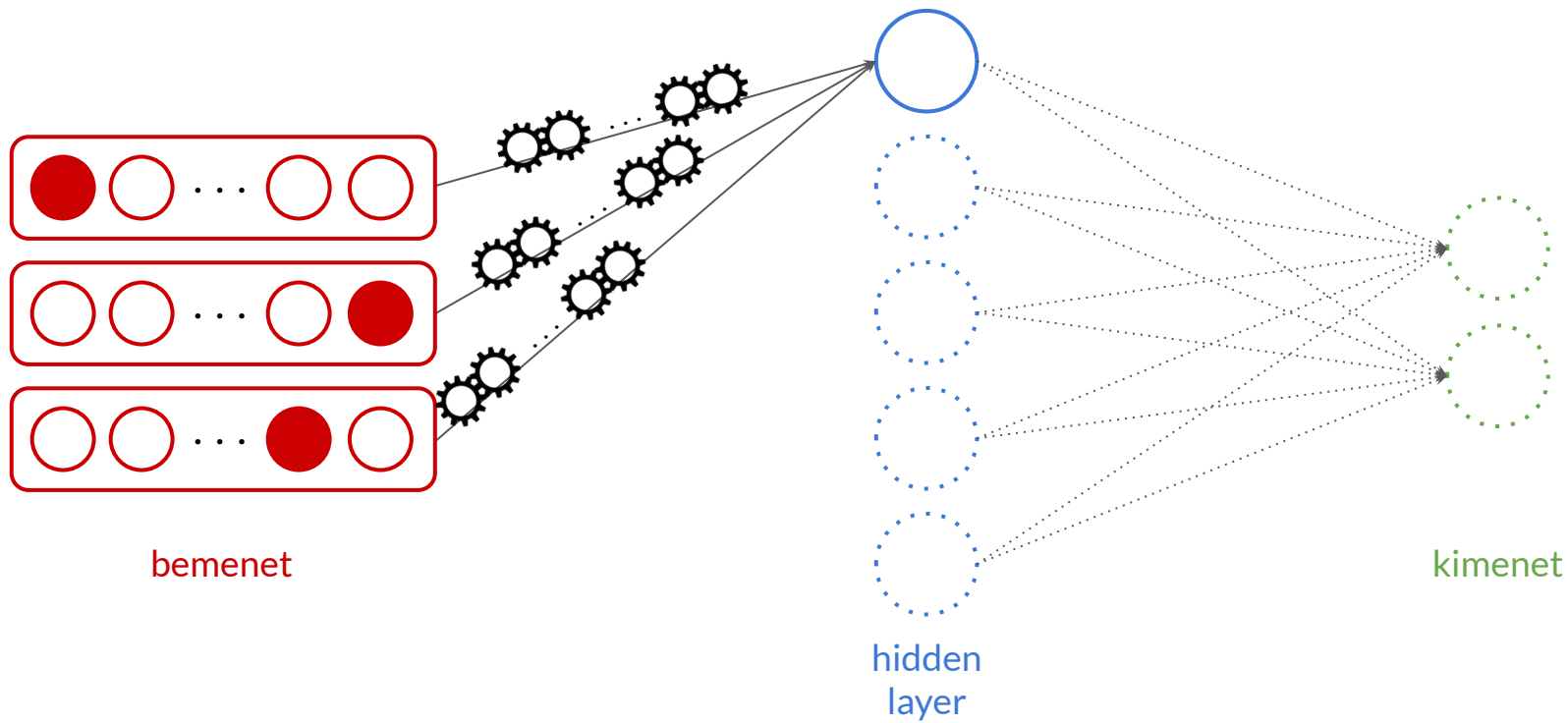
Ezt

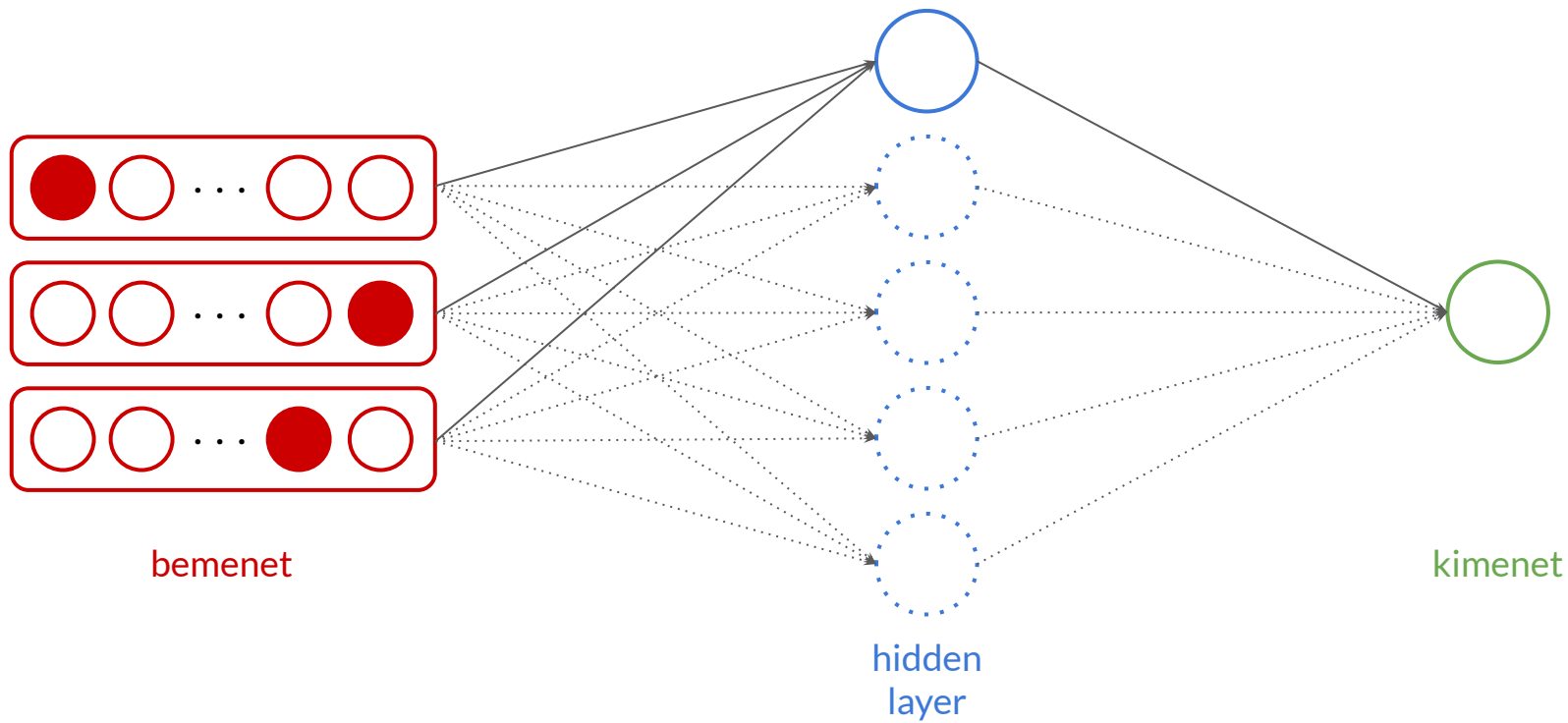
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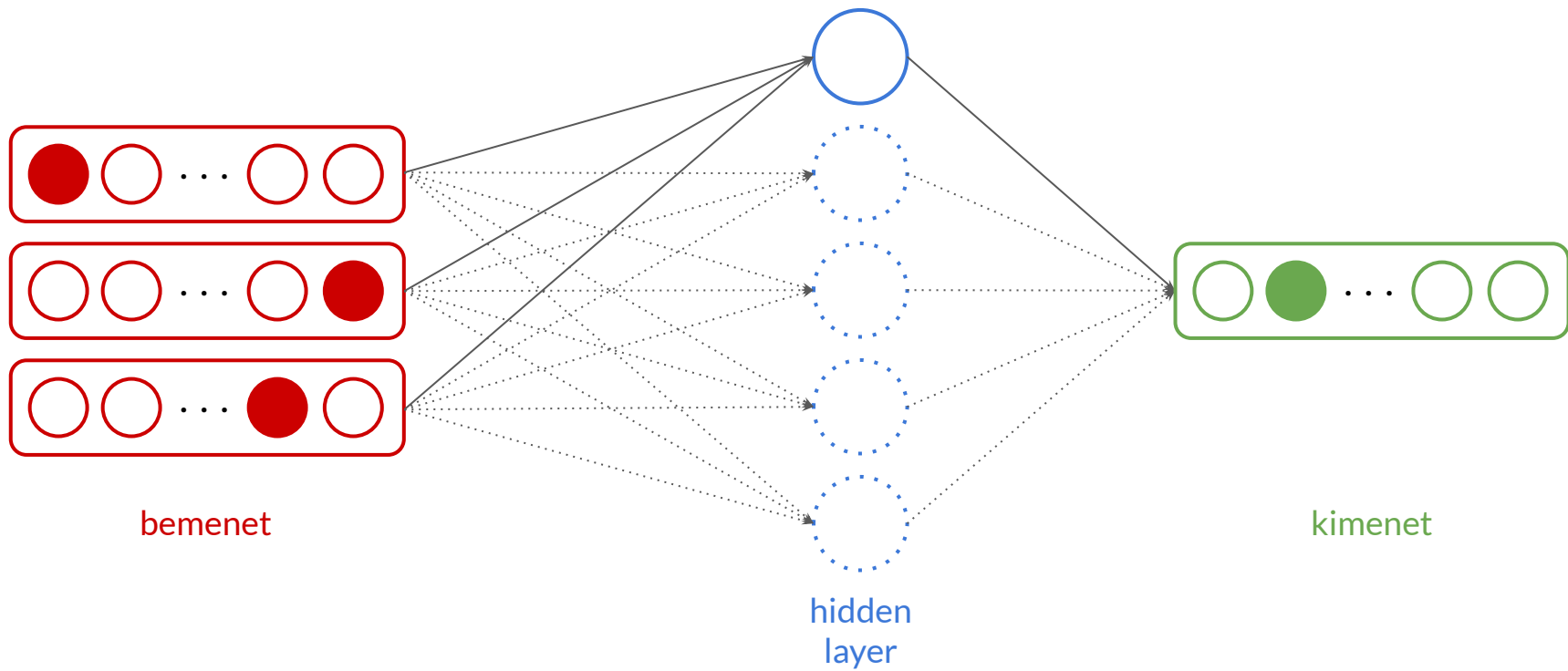
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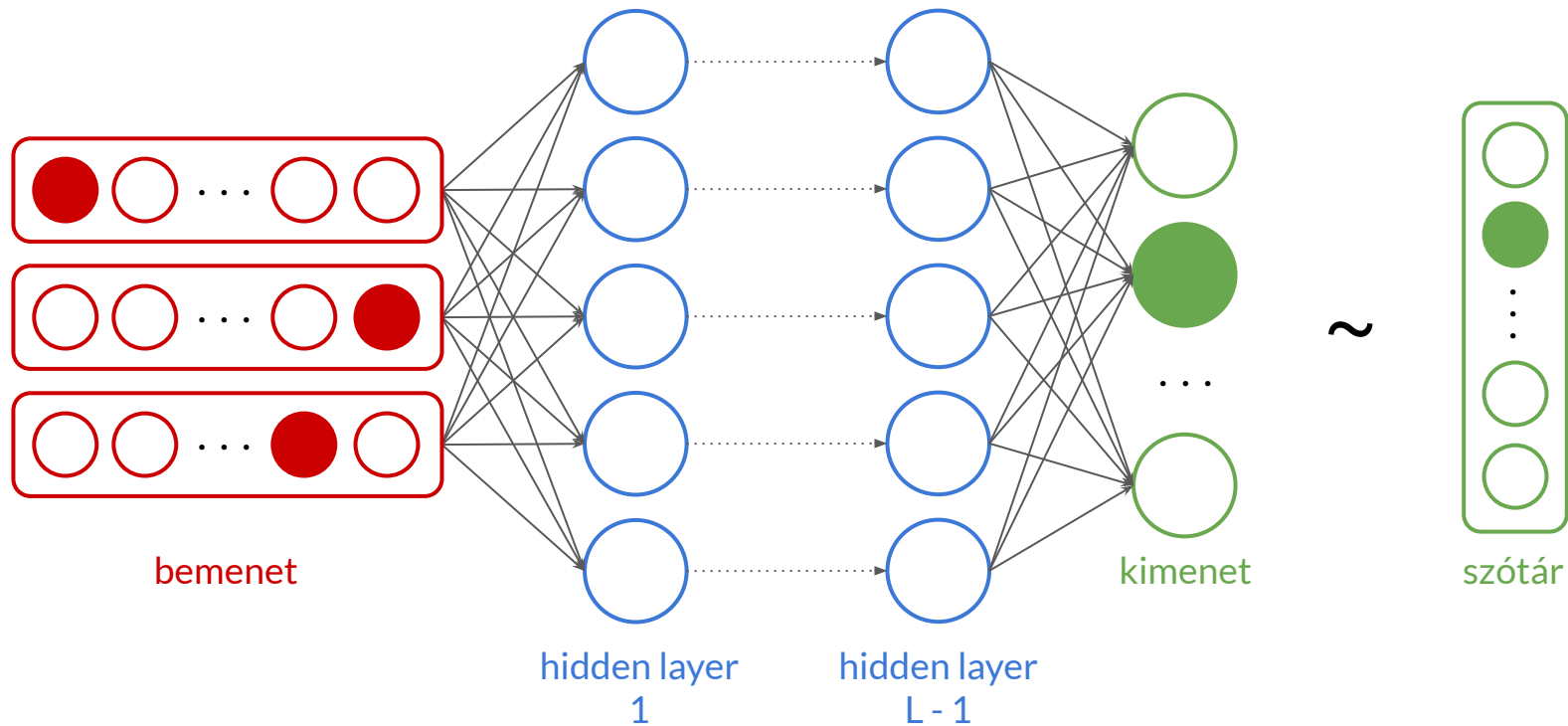
kisasszony

fiatalember









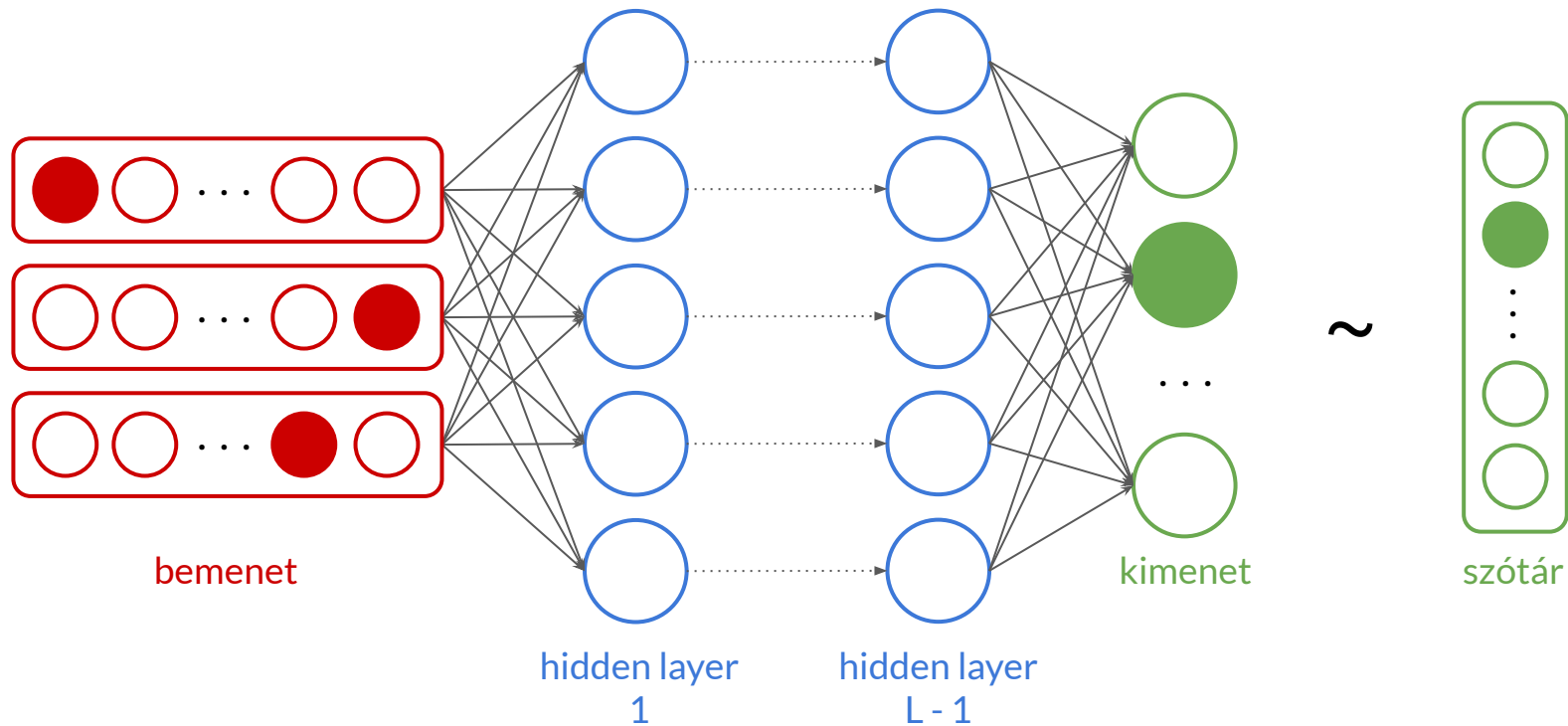
Ki mint veti _ _ _

Ki mint veti ágát, _ _ _

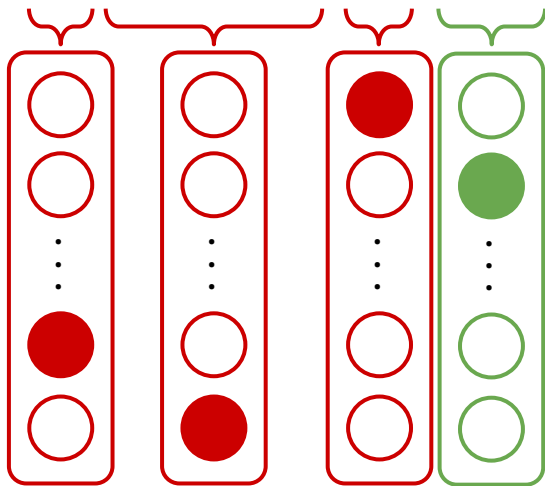
Ki mint veti ágát, úgy _ _ _

Ki mint veti ágyát, úgy alussza _ _ _

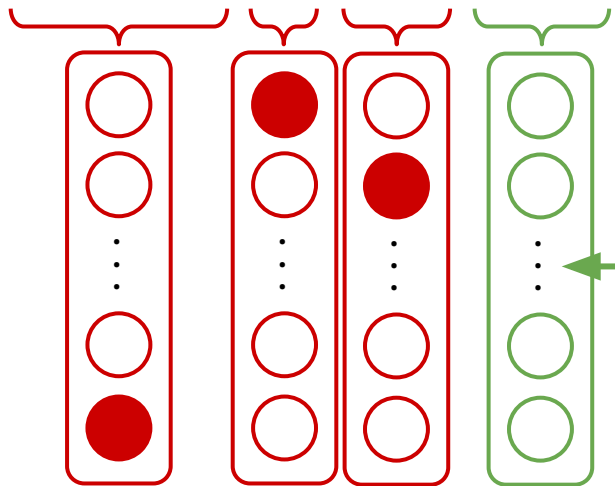
Ki mint veti ágyát, úgy alussza álmát



Az emlékezet egy folyó, amely mindig visszafelé folyik.



Az emlékezet egy folyó, amely mindig visszafelé folyik.



Az emlékezet egy folyó, amely mindig visszafelé folyik.

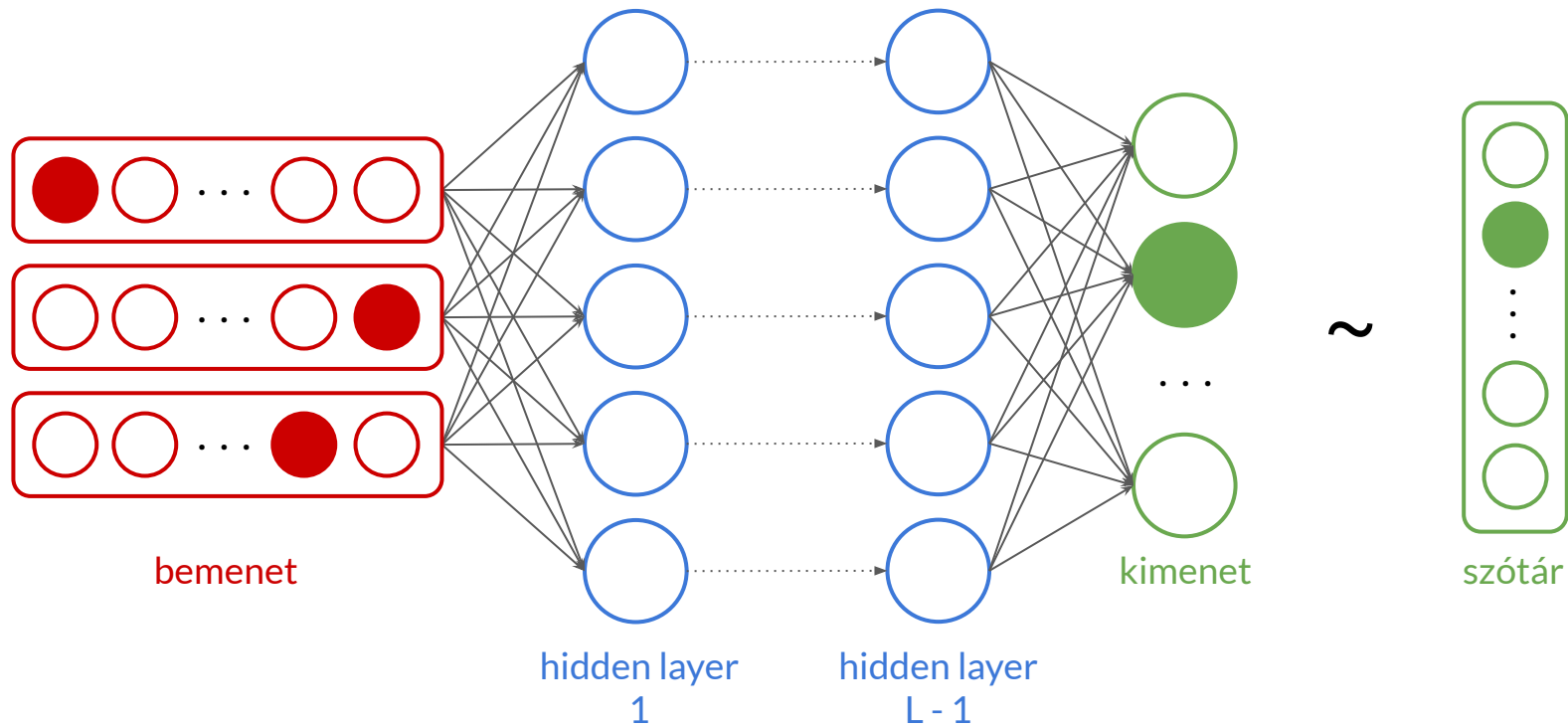


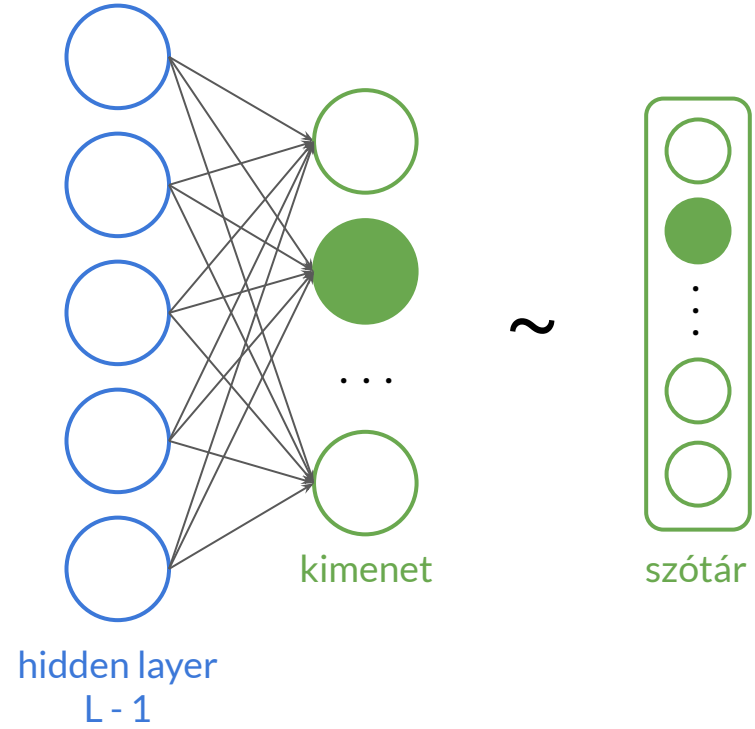
Az emlékezet egy folyó, amely mindig visszafelé folyik.

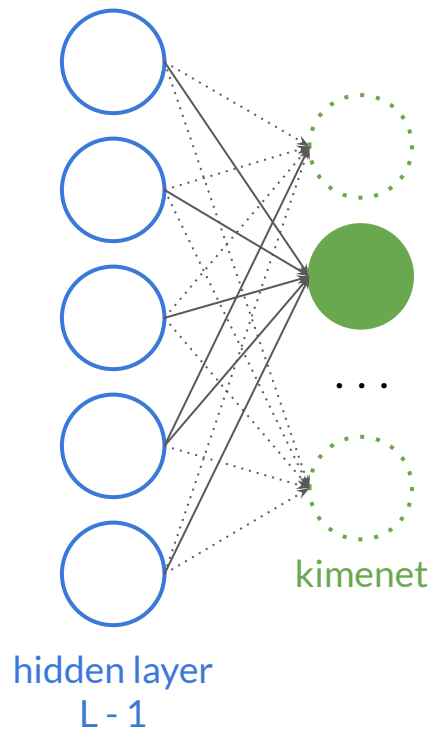


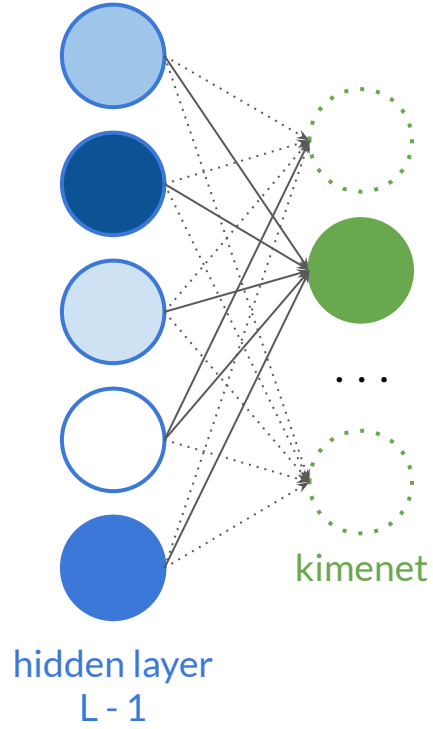
Az emlékezet egy folyó, amely mindig visszafelé folyik.

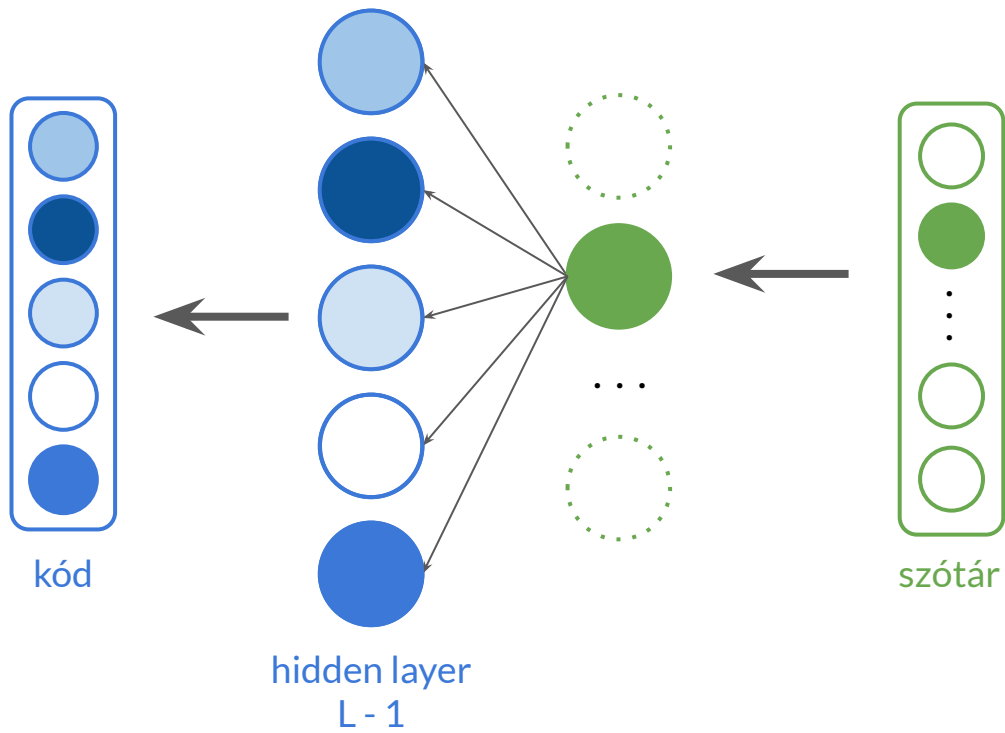


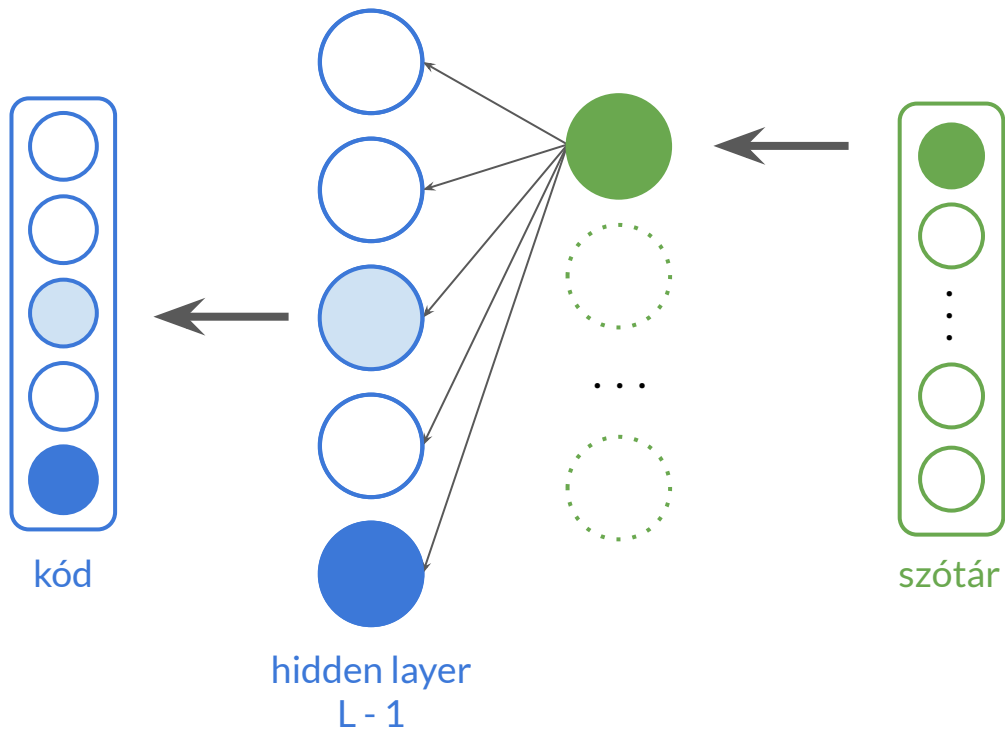


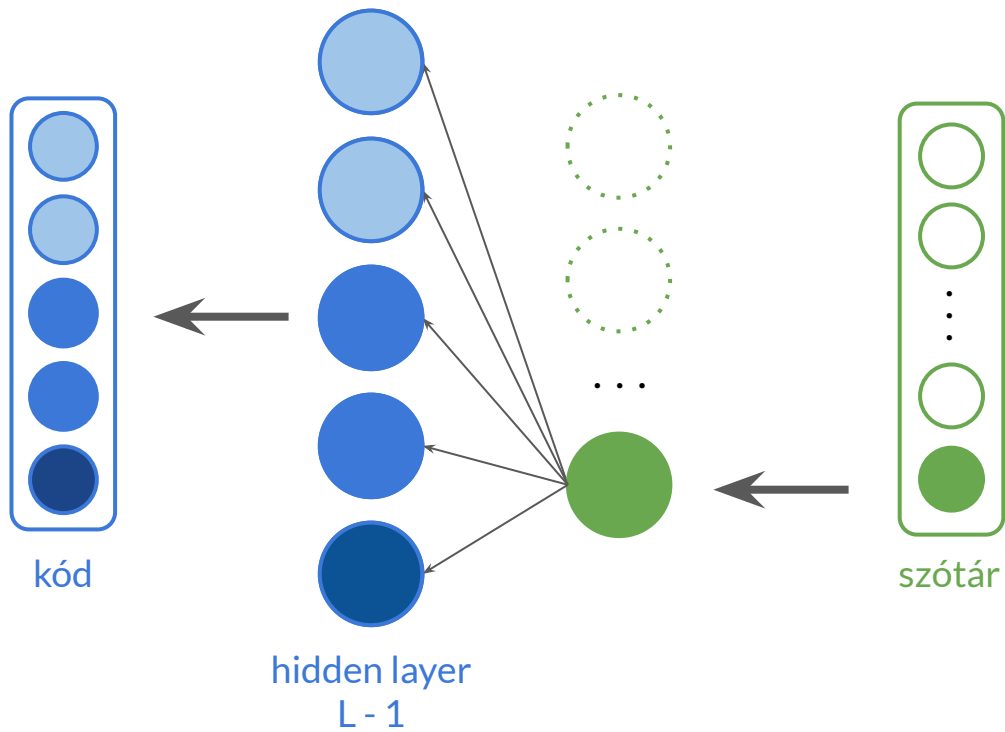












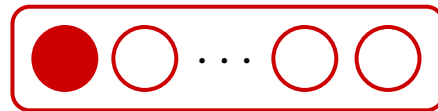
sorszám

sorszám

1. Szó



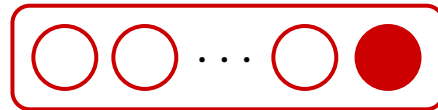
1



2. Szó



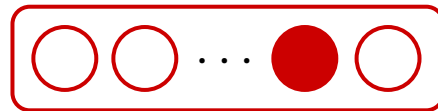
100



3. Szó



99



a szövegben

a szótárban

feldolgozható
bemenet

sorszám

sorszám

1. Szó



1



2. Szó



100



3. Szó



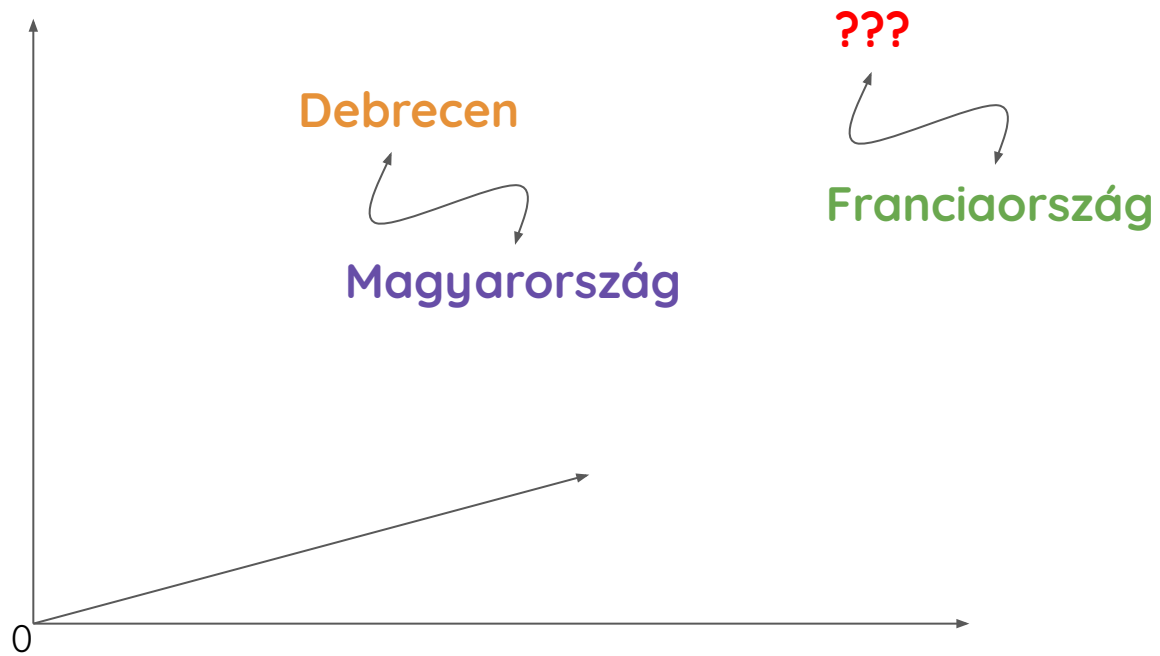
99

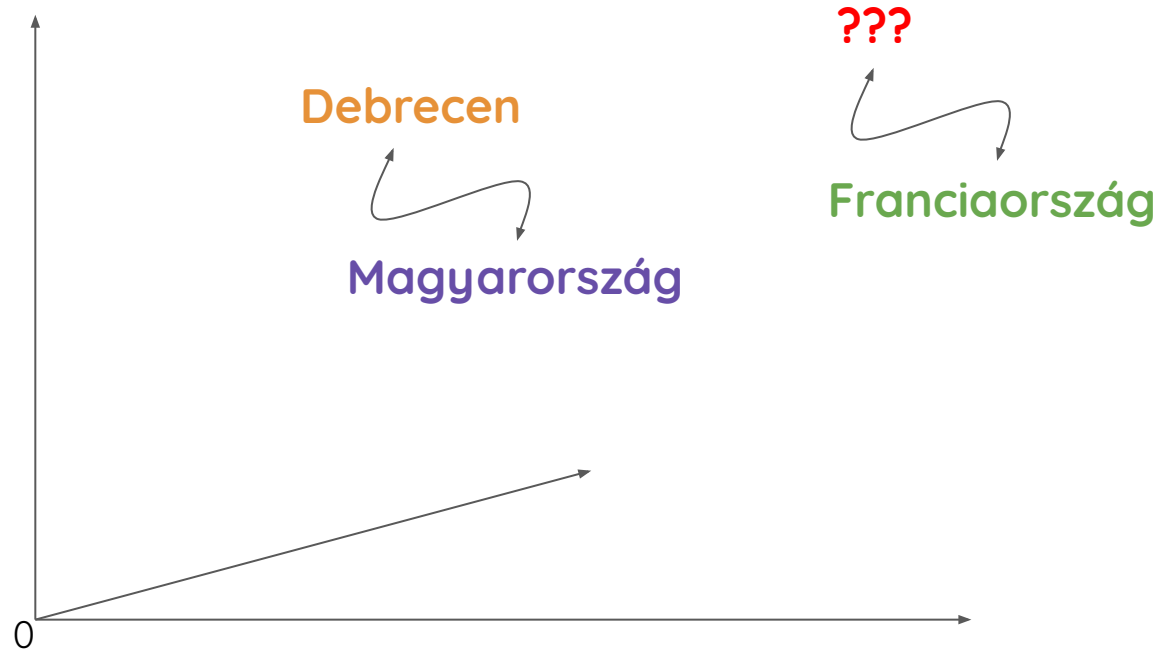


a szövegben

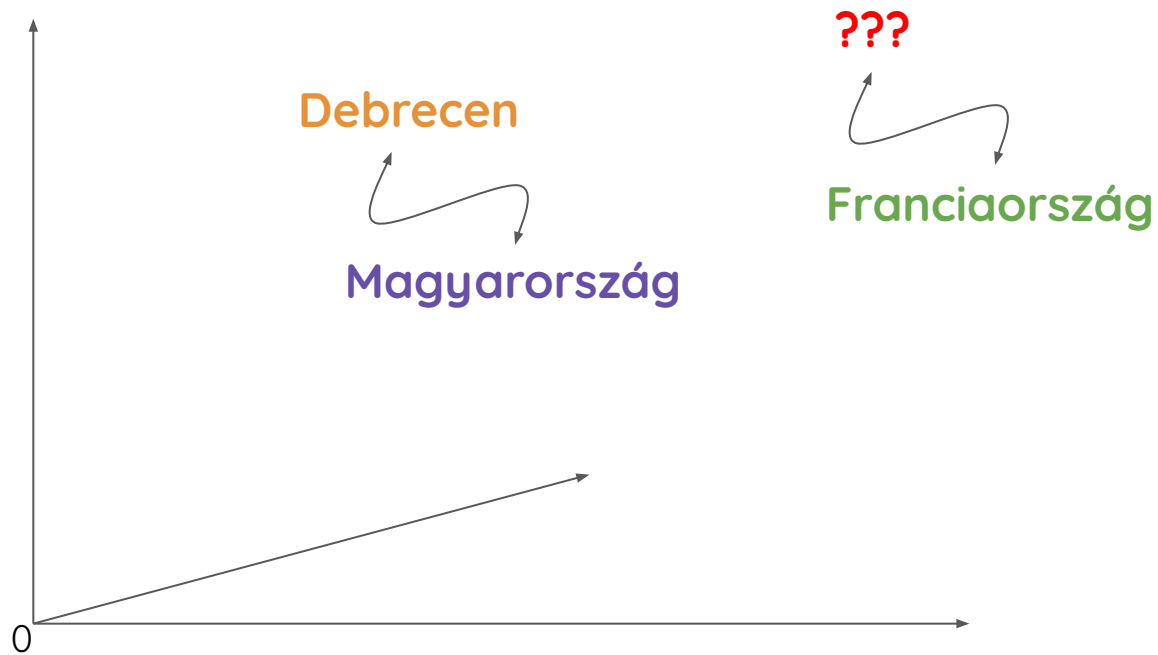
a szótárban

feldolgozható
bemenet

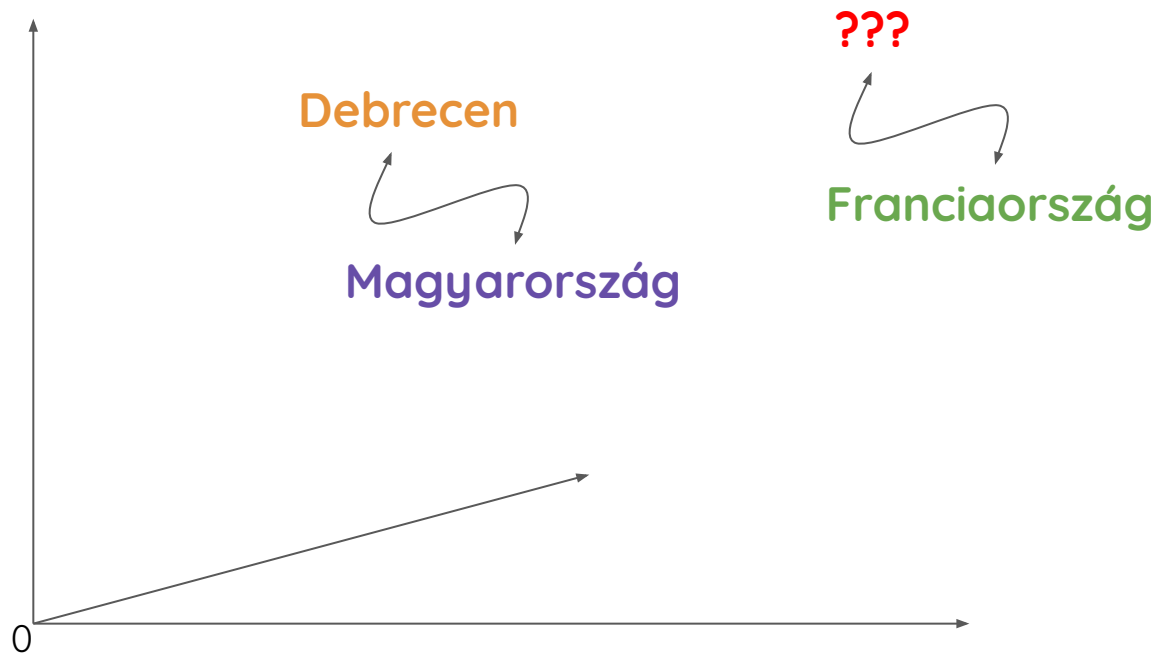




“Debrecen” - “Magyarország”



(“Debrecen” - “Magyarország”) + “Franciaország”



$$(\text{"Debrecen"} - \text{"Magyarország"}) + \text{"Franciaország"} = ???$$

Debrecen

-

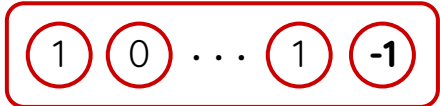
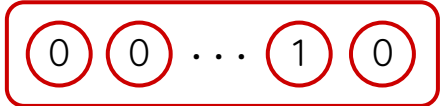
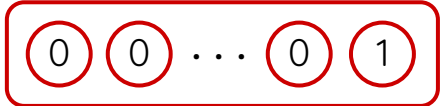
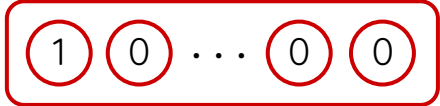
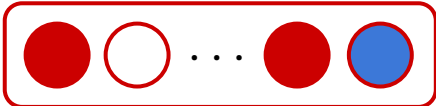
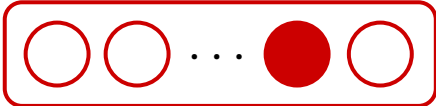
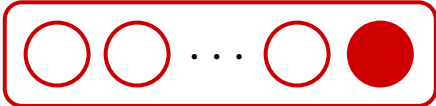
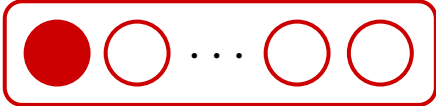
Magyarország

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Franciaország

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Debrecen

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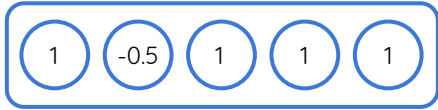
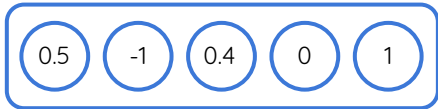
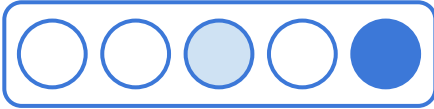
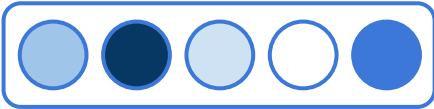
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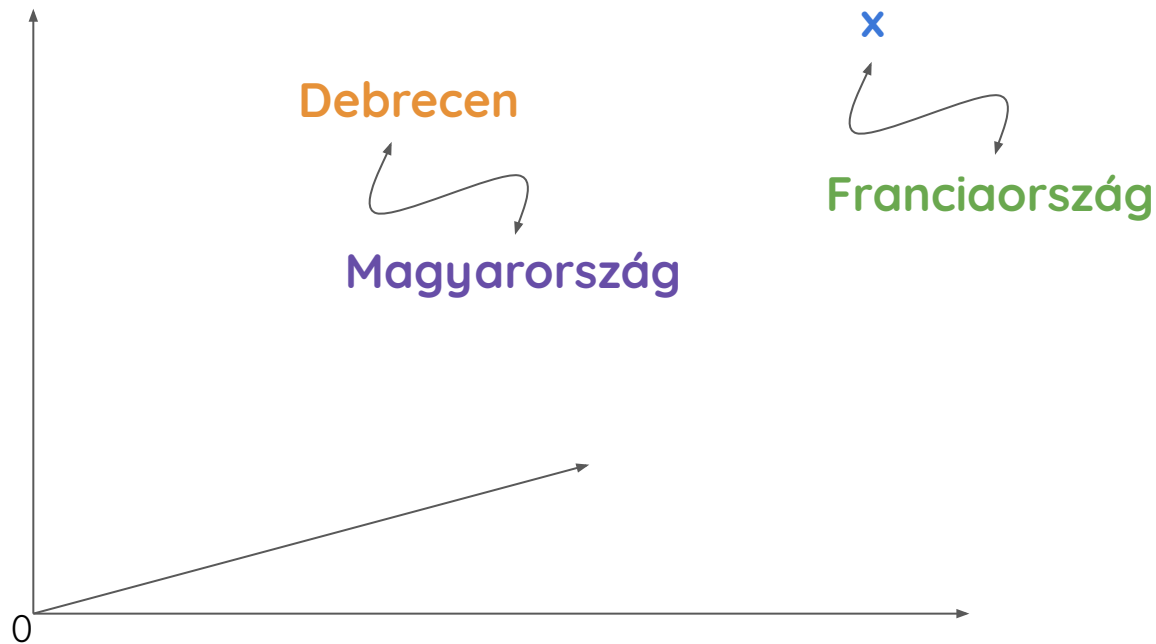
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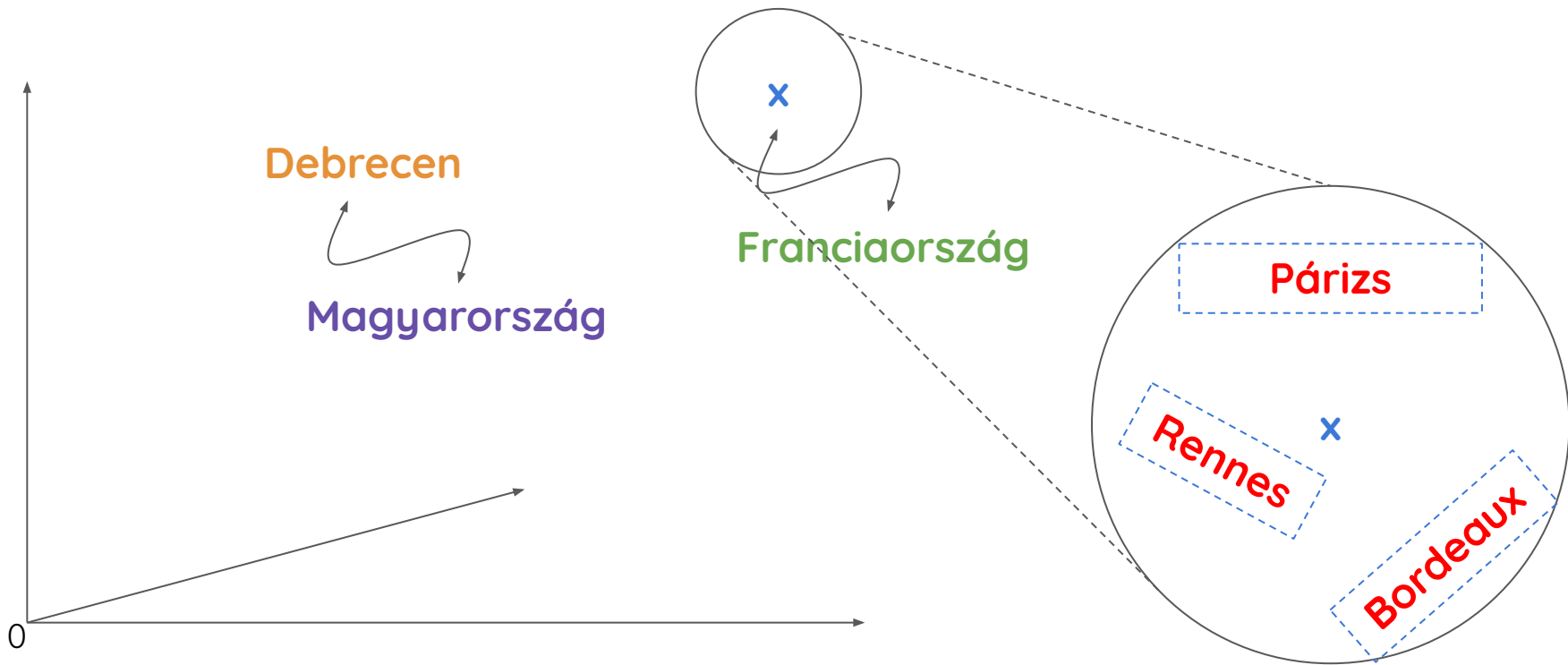
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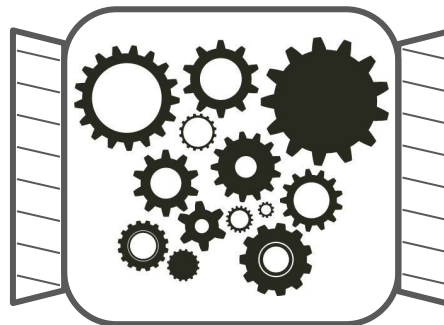
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Jaj, be szép, hogy vagyok,
Jaj, be szép, hogy vagynak,
Jaj, be szép, hogy minden Való szép,
Jaj, be szép a Szép.



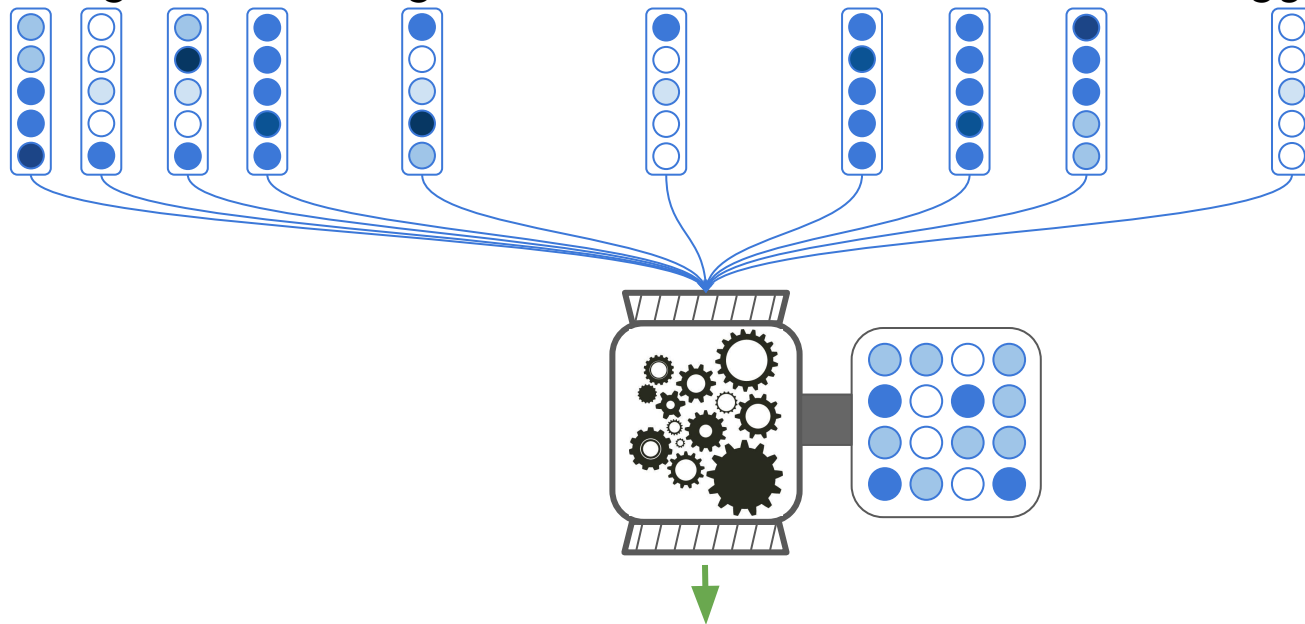
“szép”



100%
“szép”

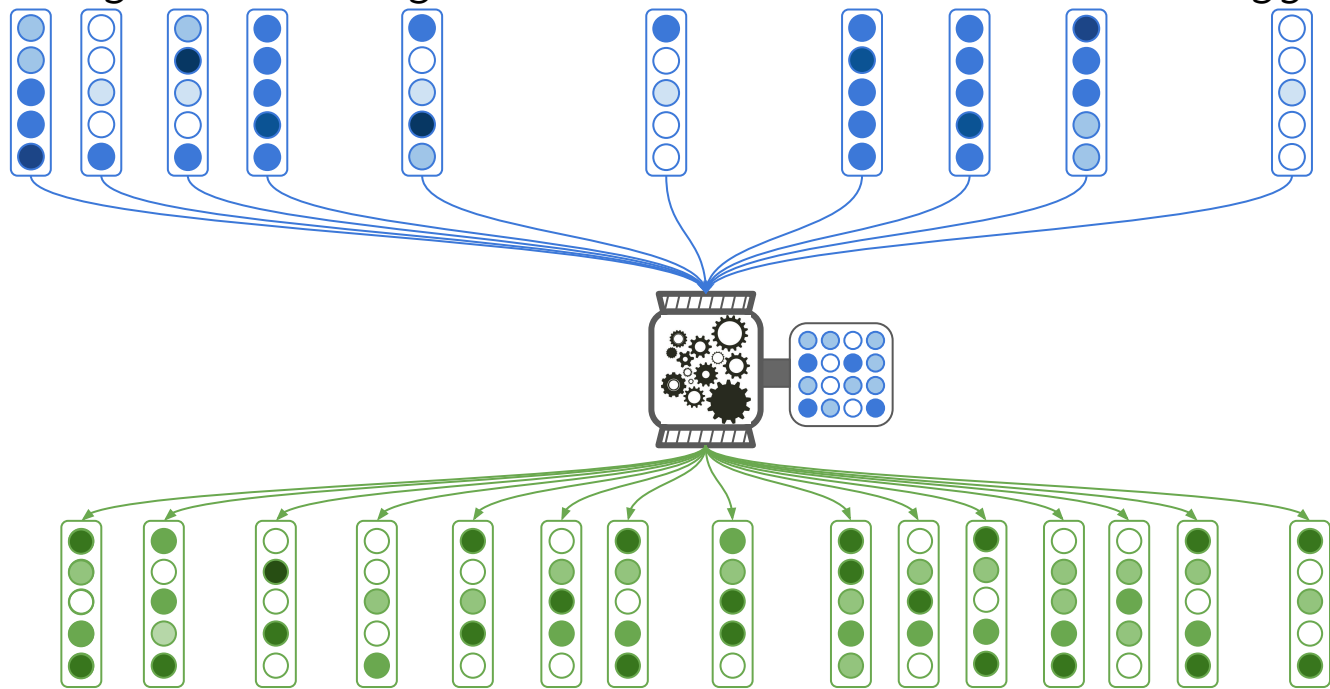
Az ég nem a csillagoknál kezdődik, hanem a fűszálak hegyénél.

Az ég nem a csillagoknál kezdődik, hanem a fűszálak hegyénél.



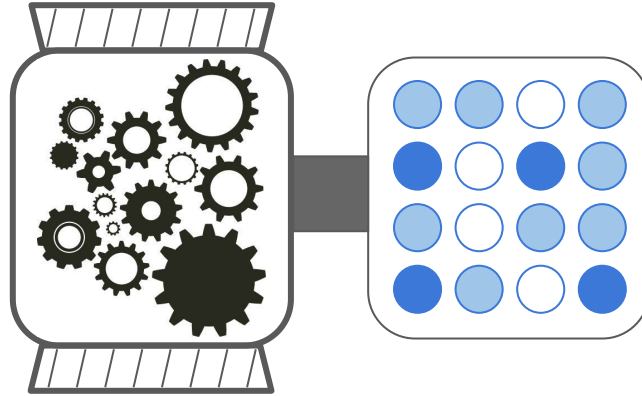
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"szép"

Az ég nem a csillagoknál kezdődik, hanem a fűszálak hegyénél.



The sky does not start at the stars, but at the tip of the grass.

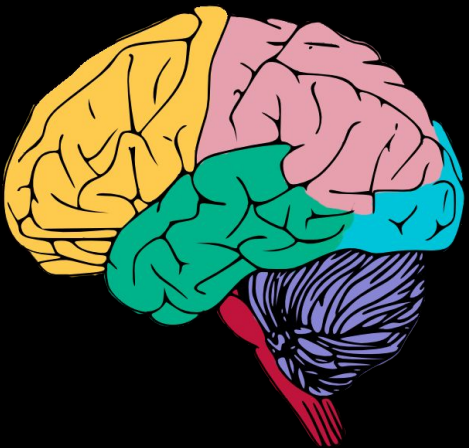
Recurrent
Neural
Network



Thought Vector



CV

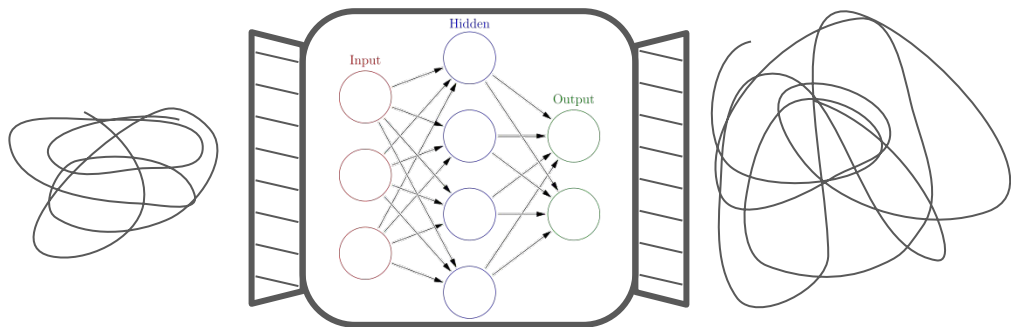


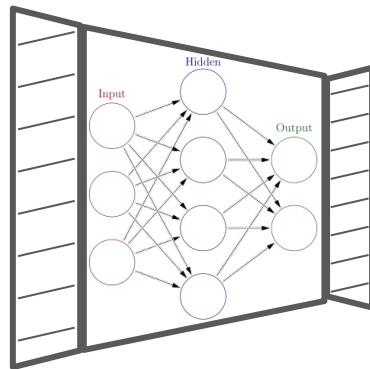
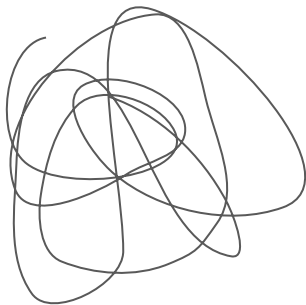
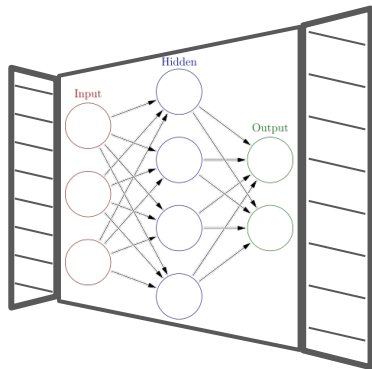


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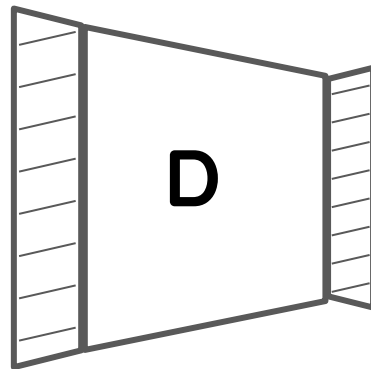
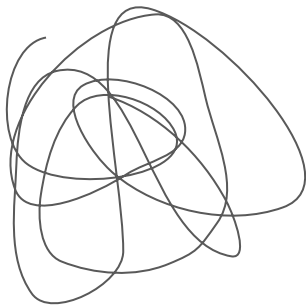
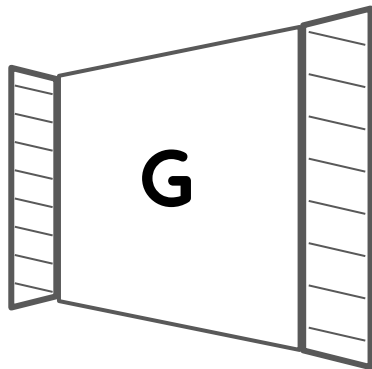
generates

Fake Faces

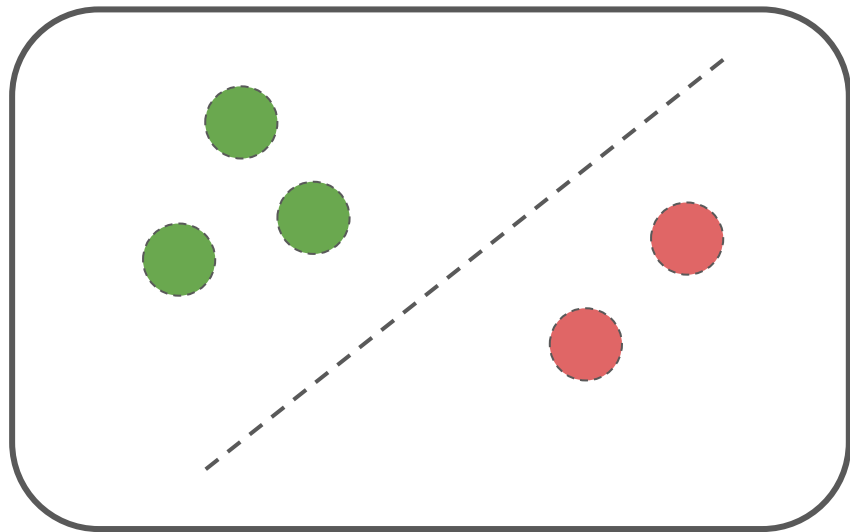


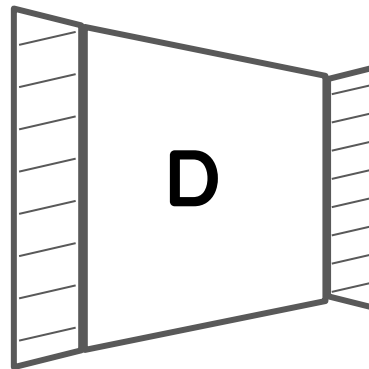
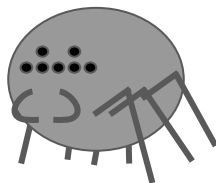
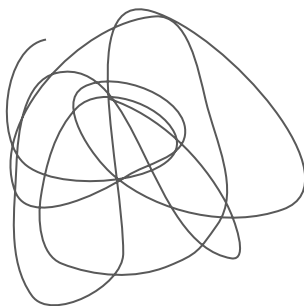
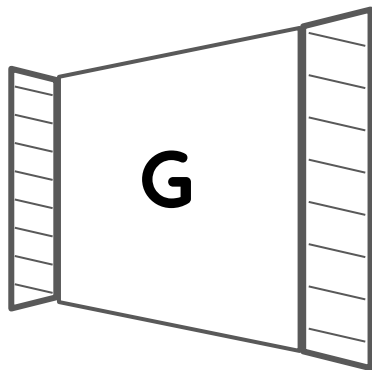


kamu?

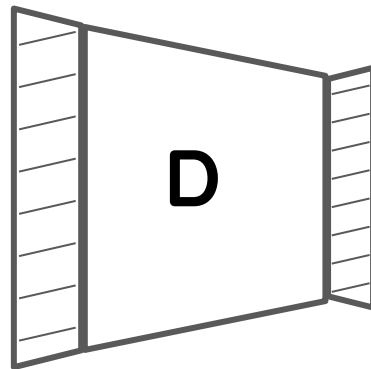
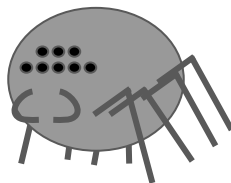
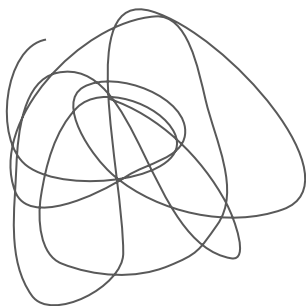
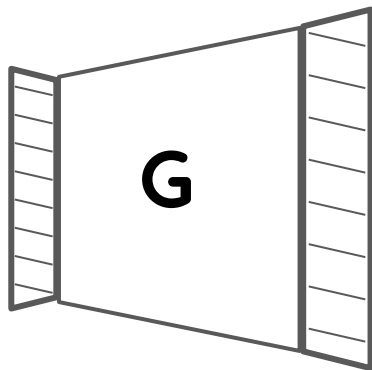


kamu?



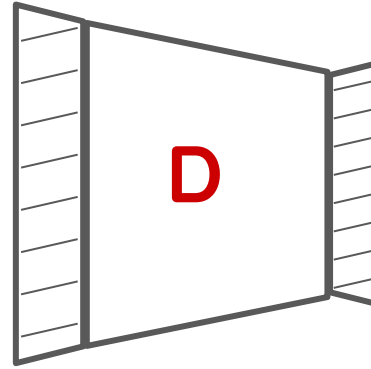
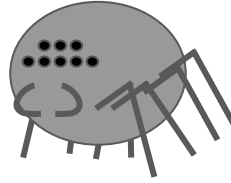


igazi
hamis

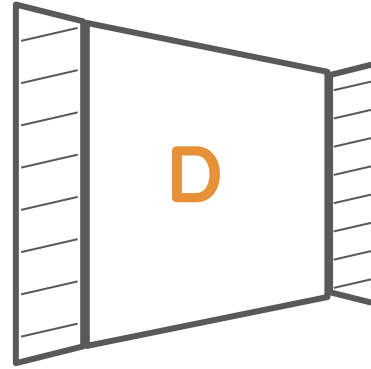
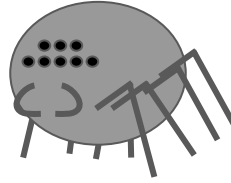


igazi
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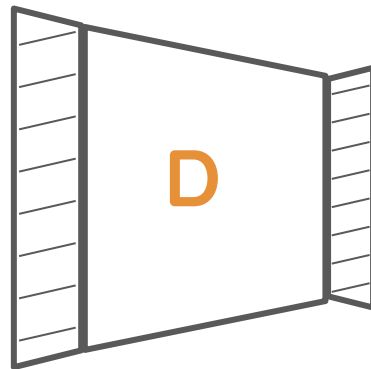
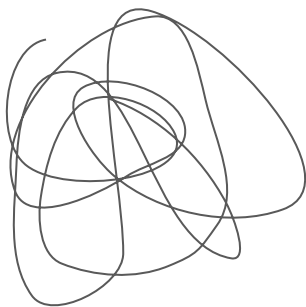
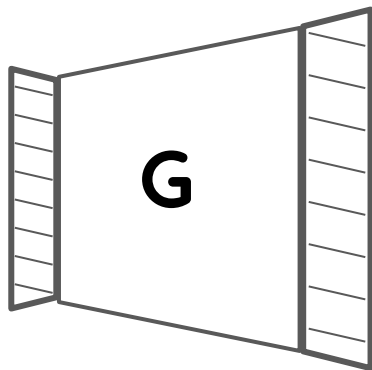
1. Kör



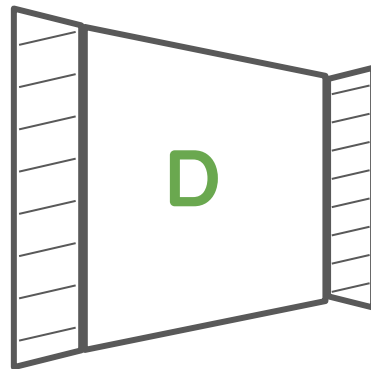
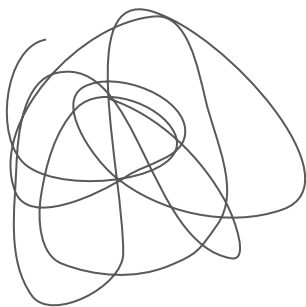
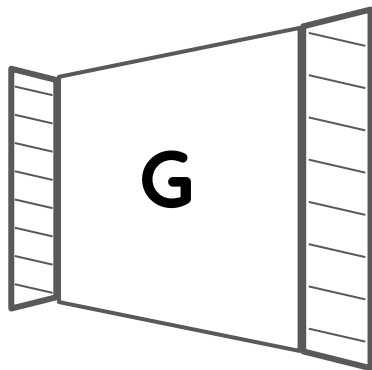
50%
igazi



100%
igazi

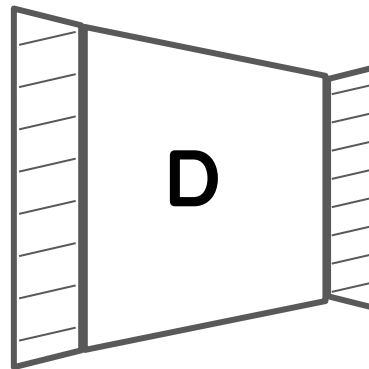
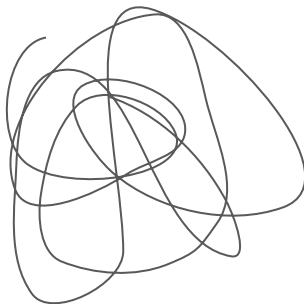
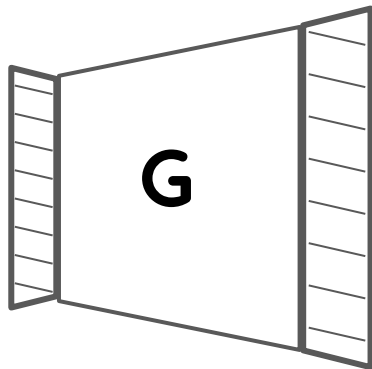


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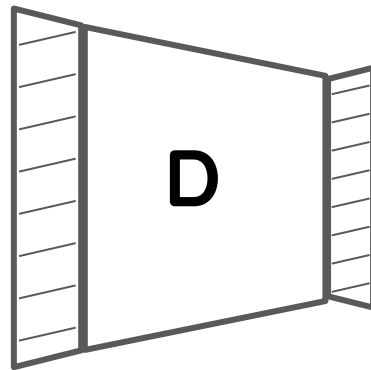
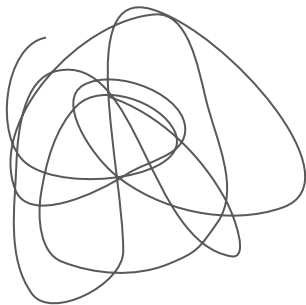
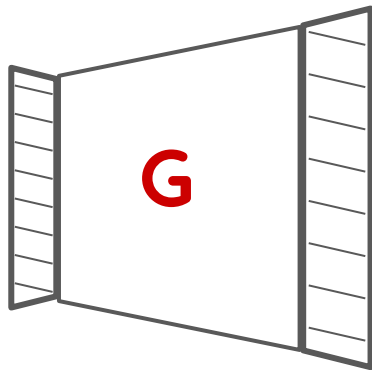


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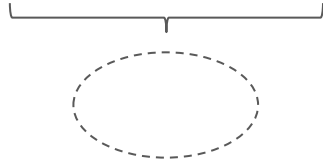
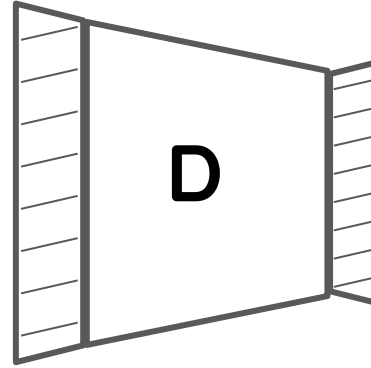
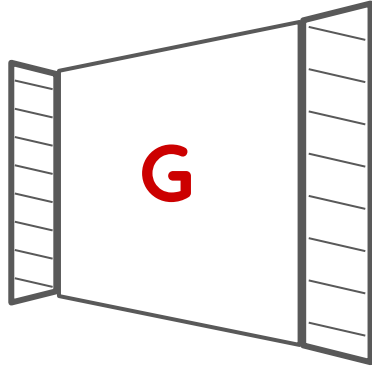
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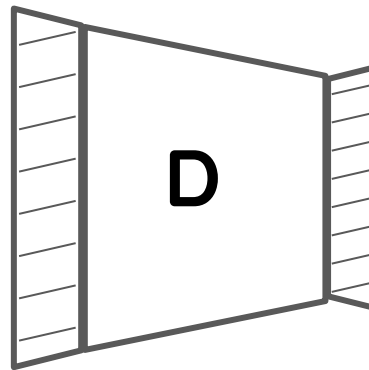
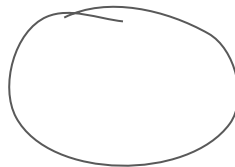
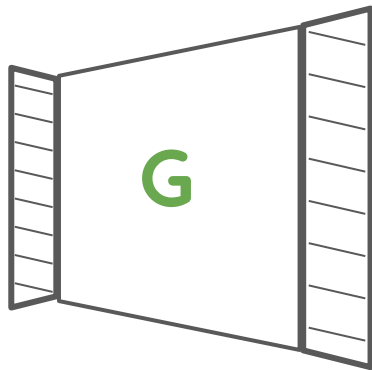
0%
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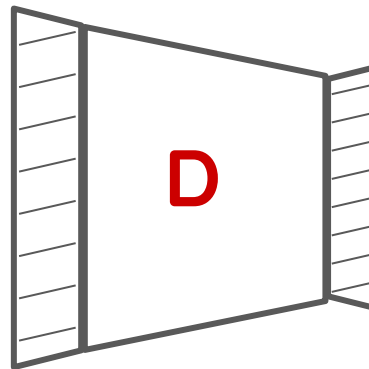
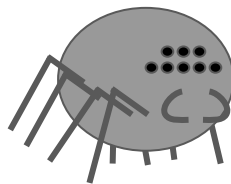


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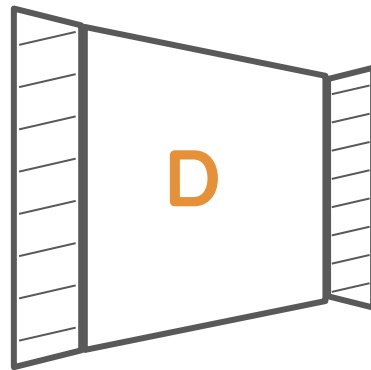
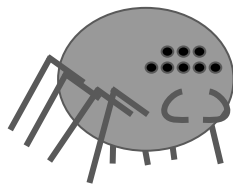


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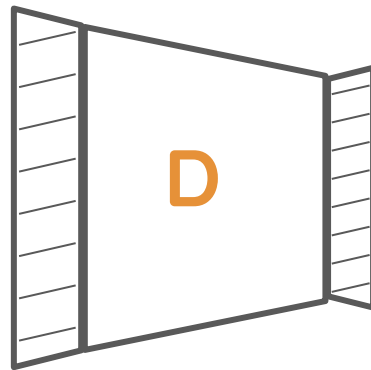
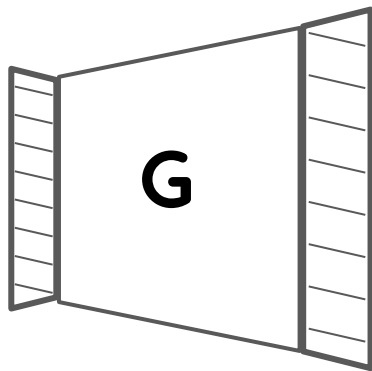
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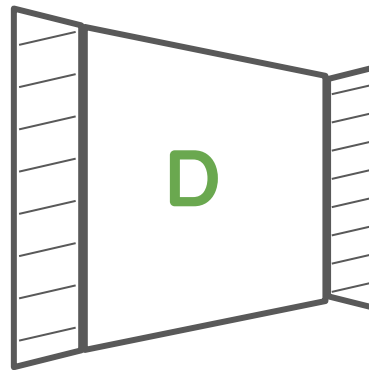
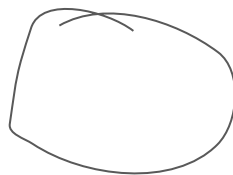
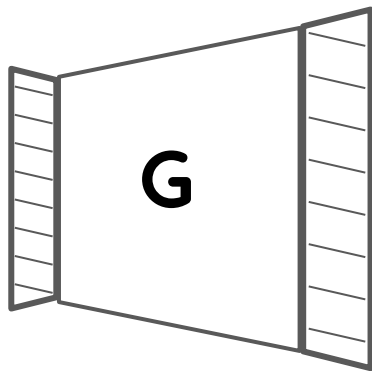
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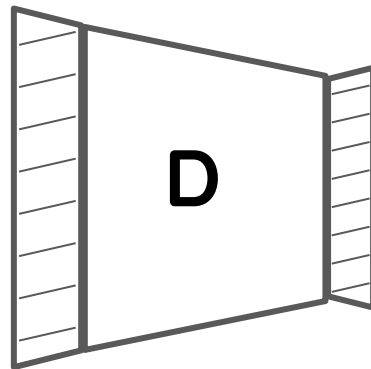
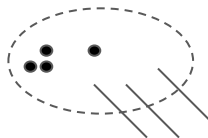
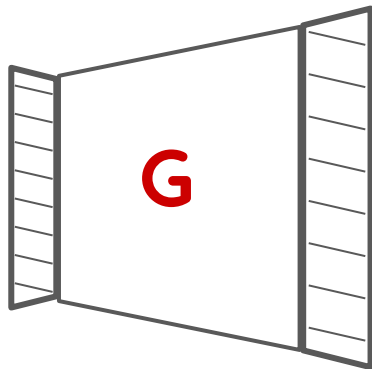


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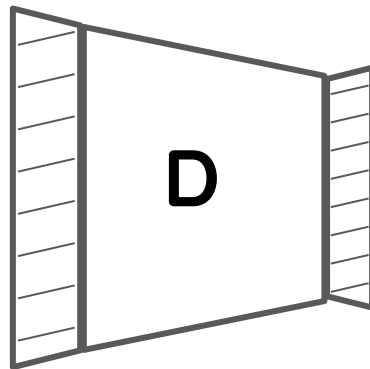
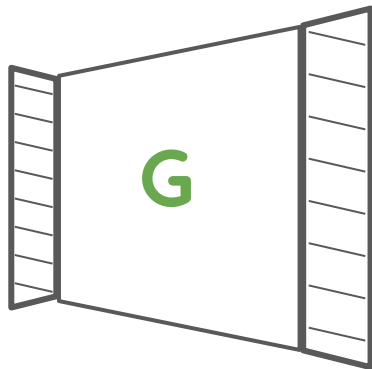


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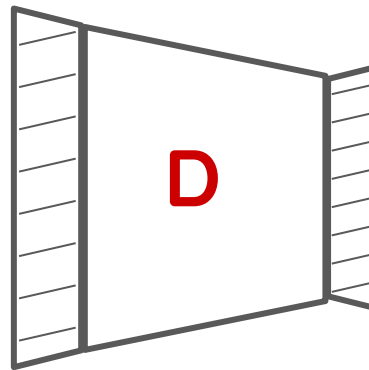
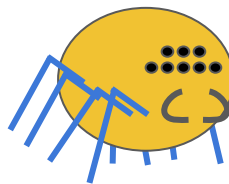


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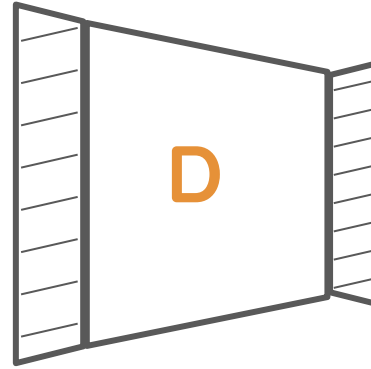
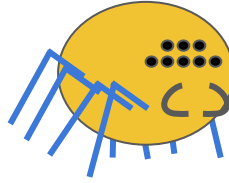


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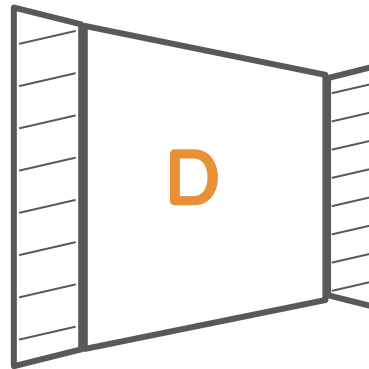
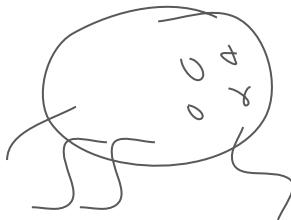
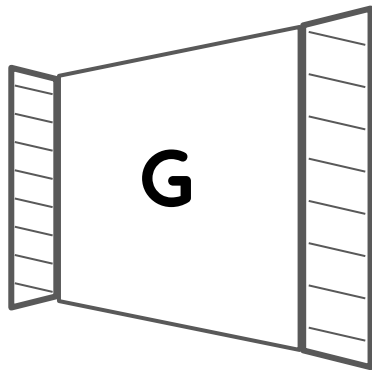
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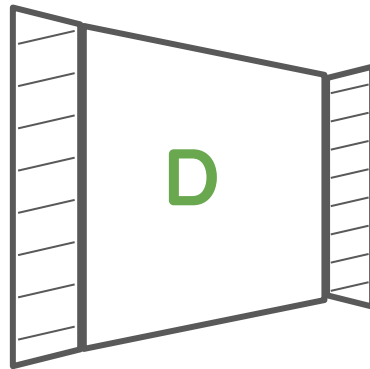
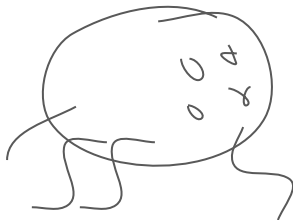
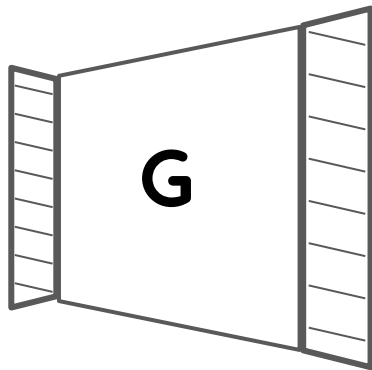
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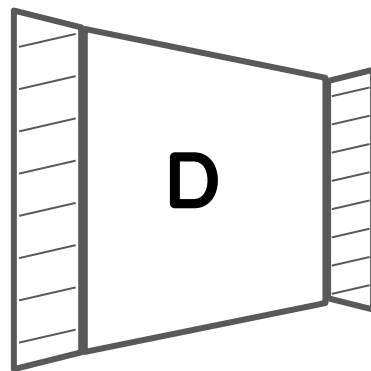
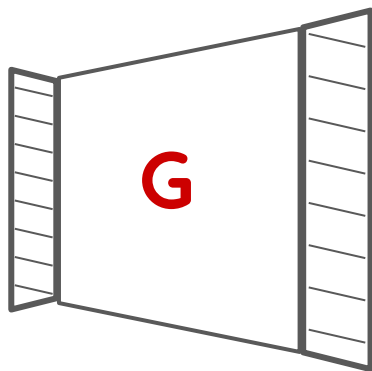


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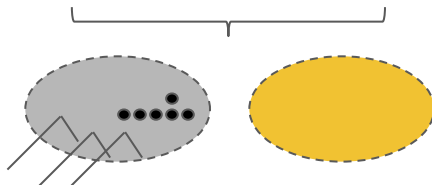


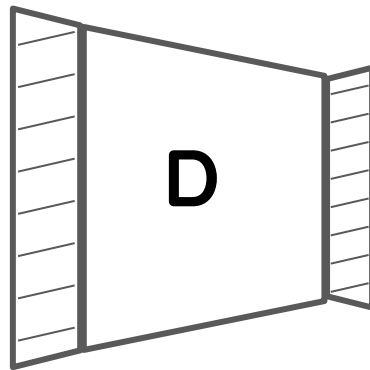
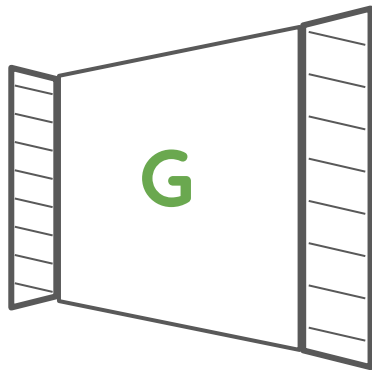
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6. Kör



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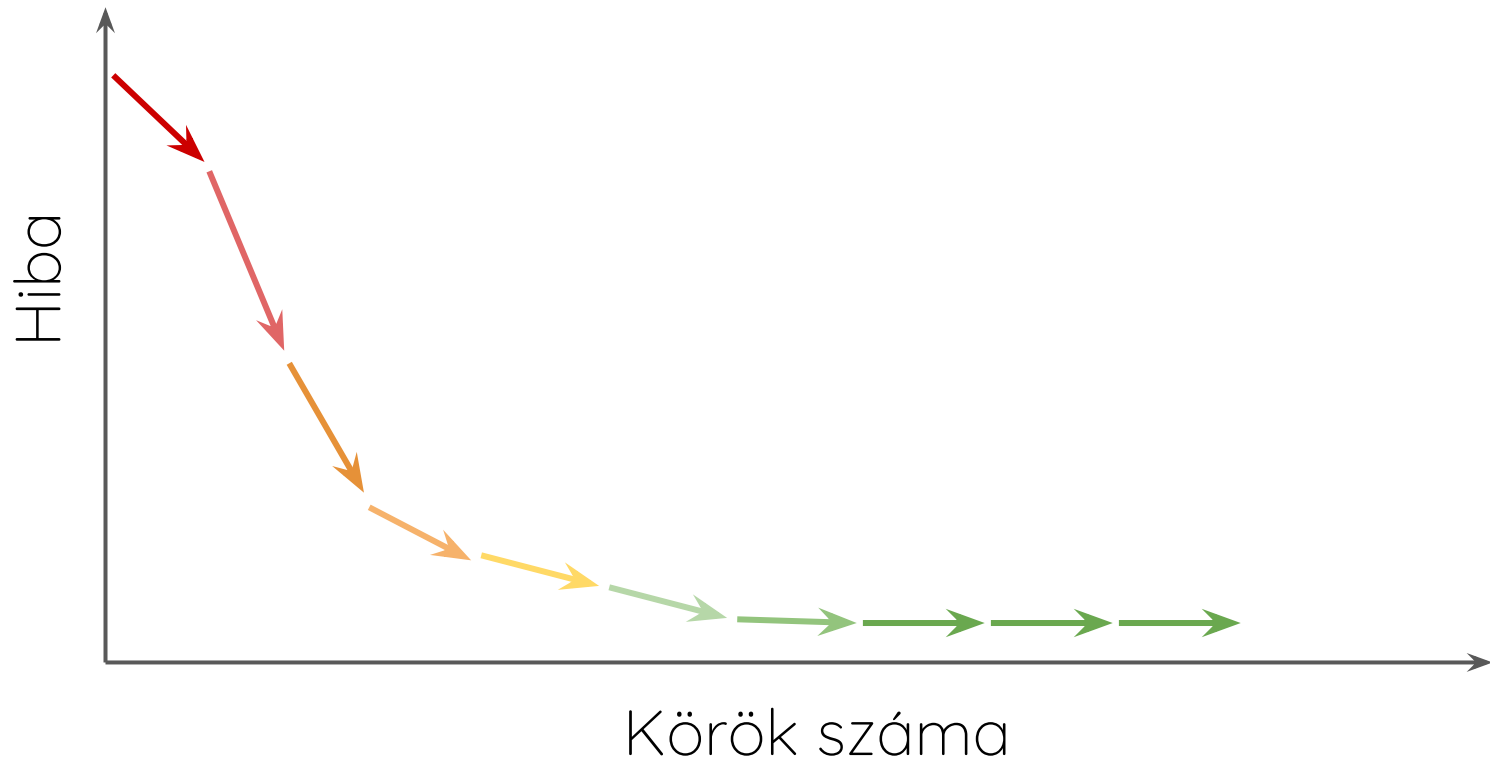




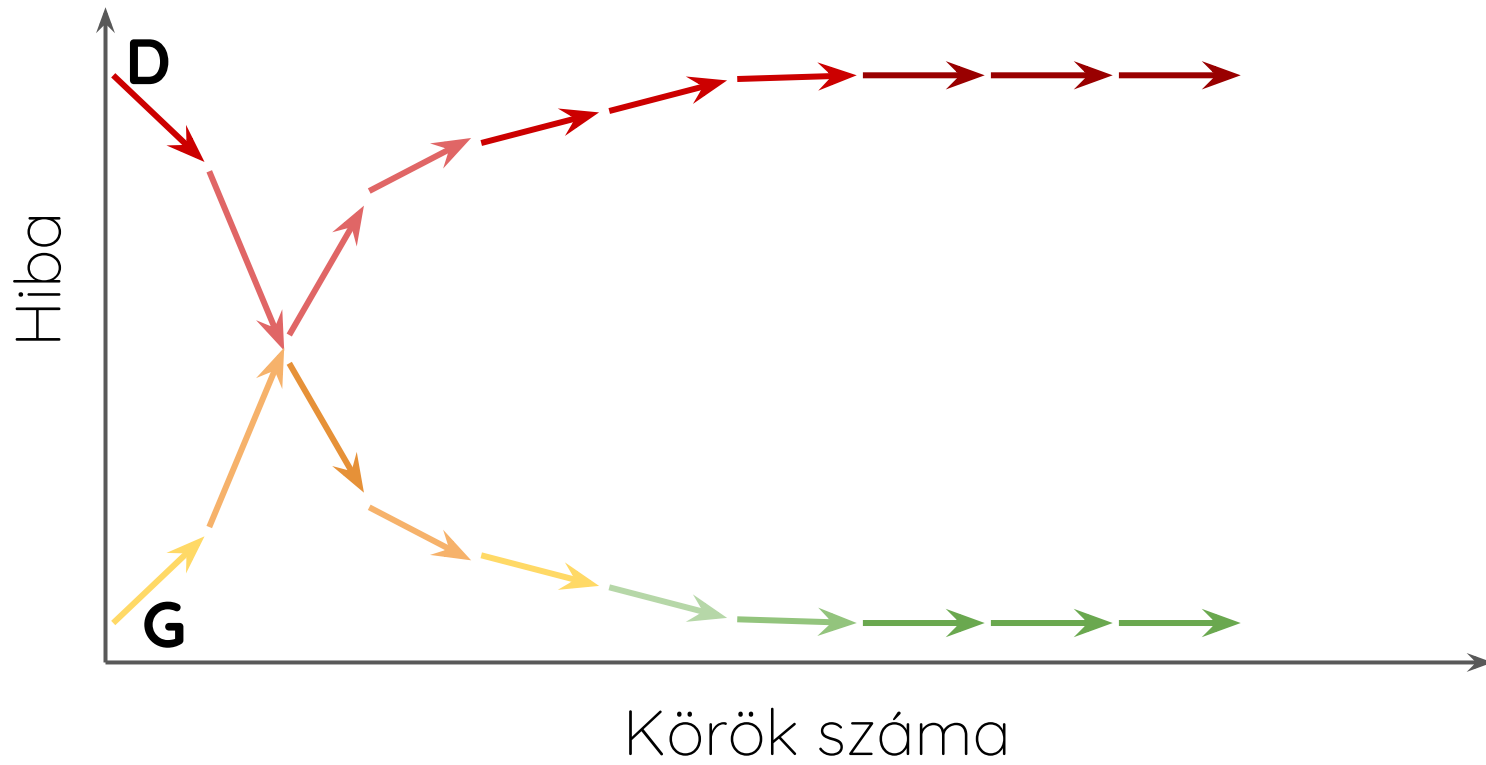
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igazi

Generative Adversarial Networks

Egyszerű tanítás

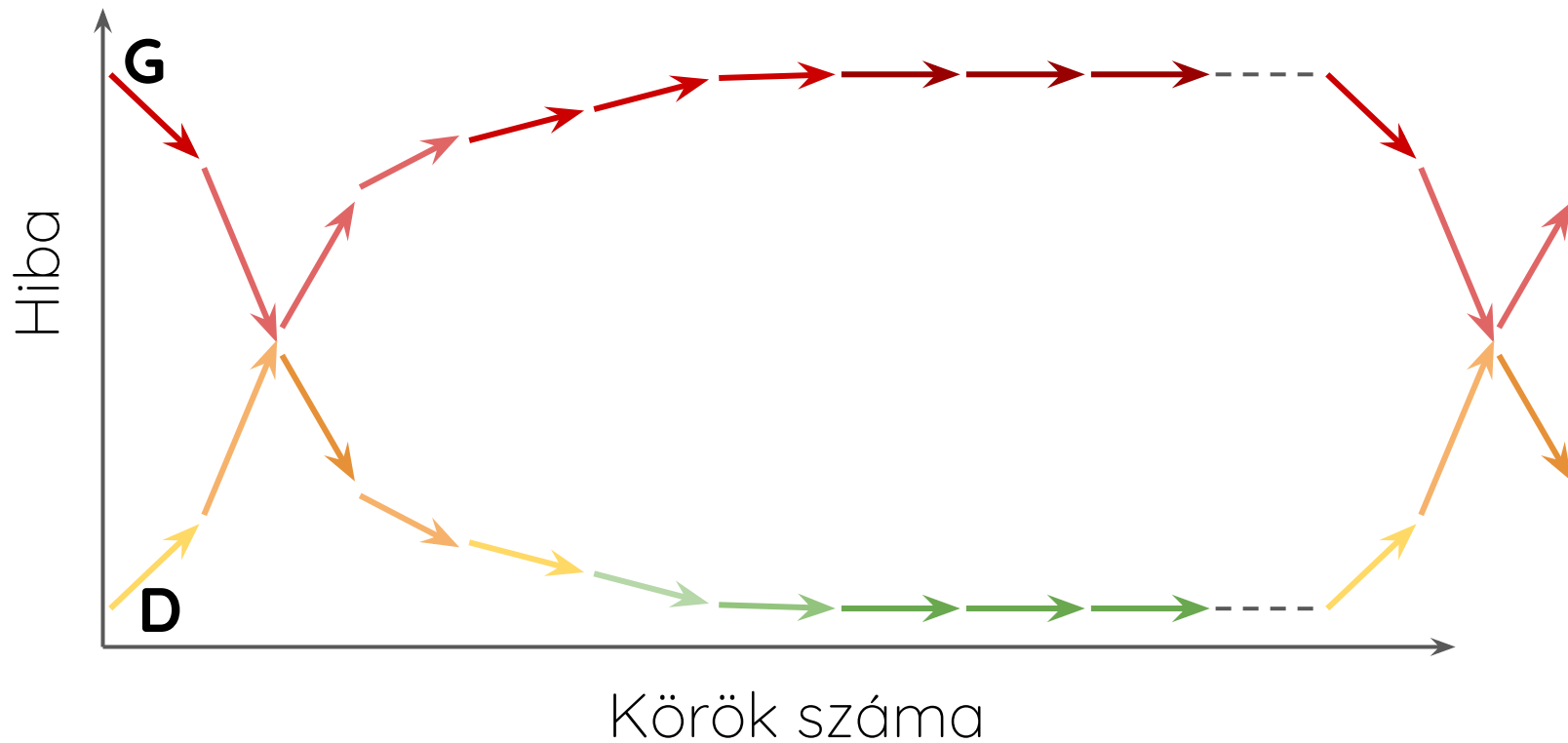


GAN - D tanítás



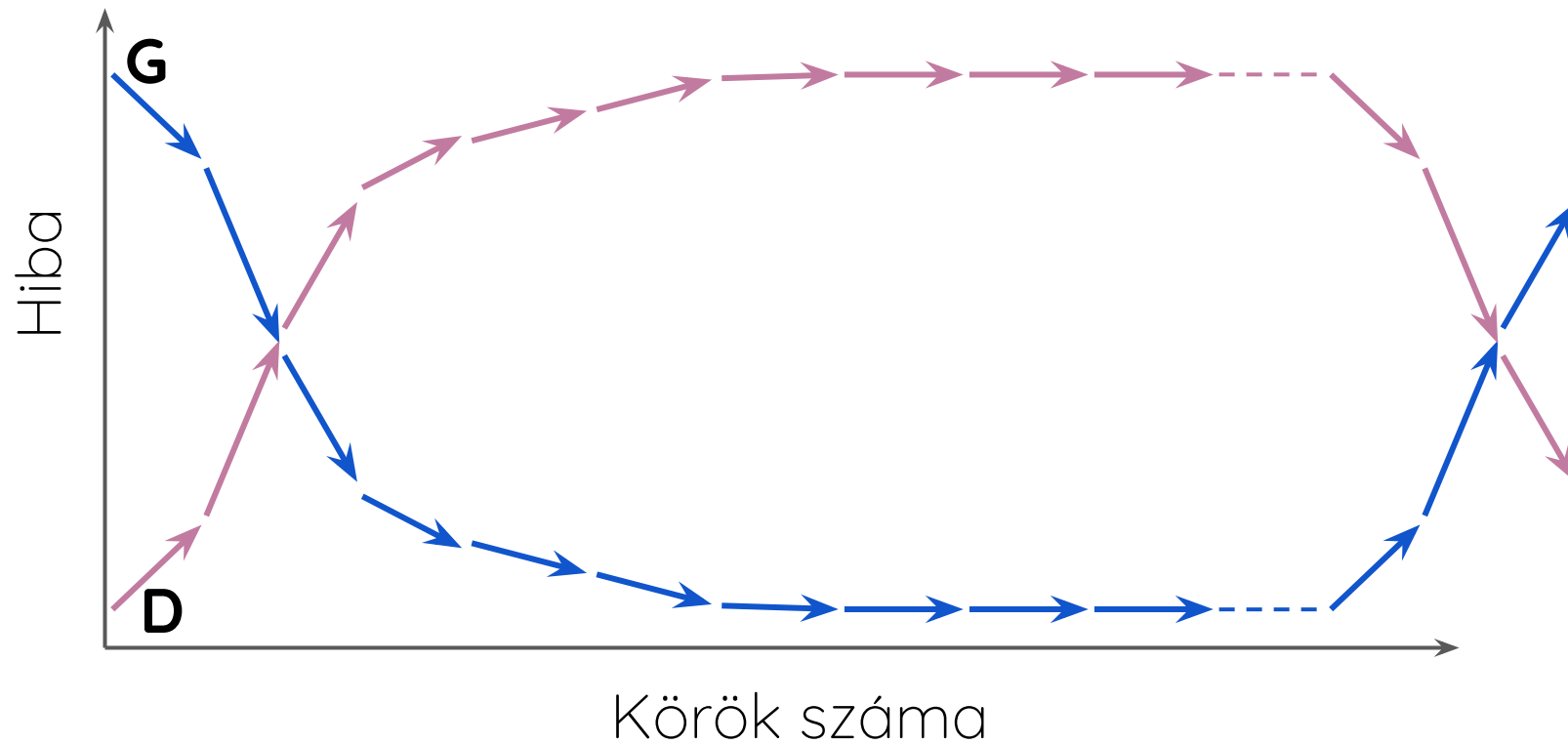
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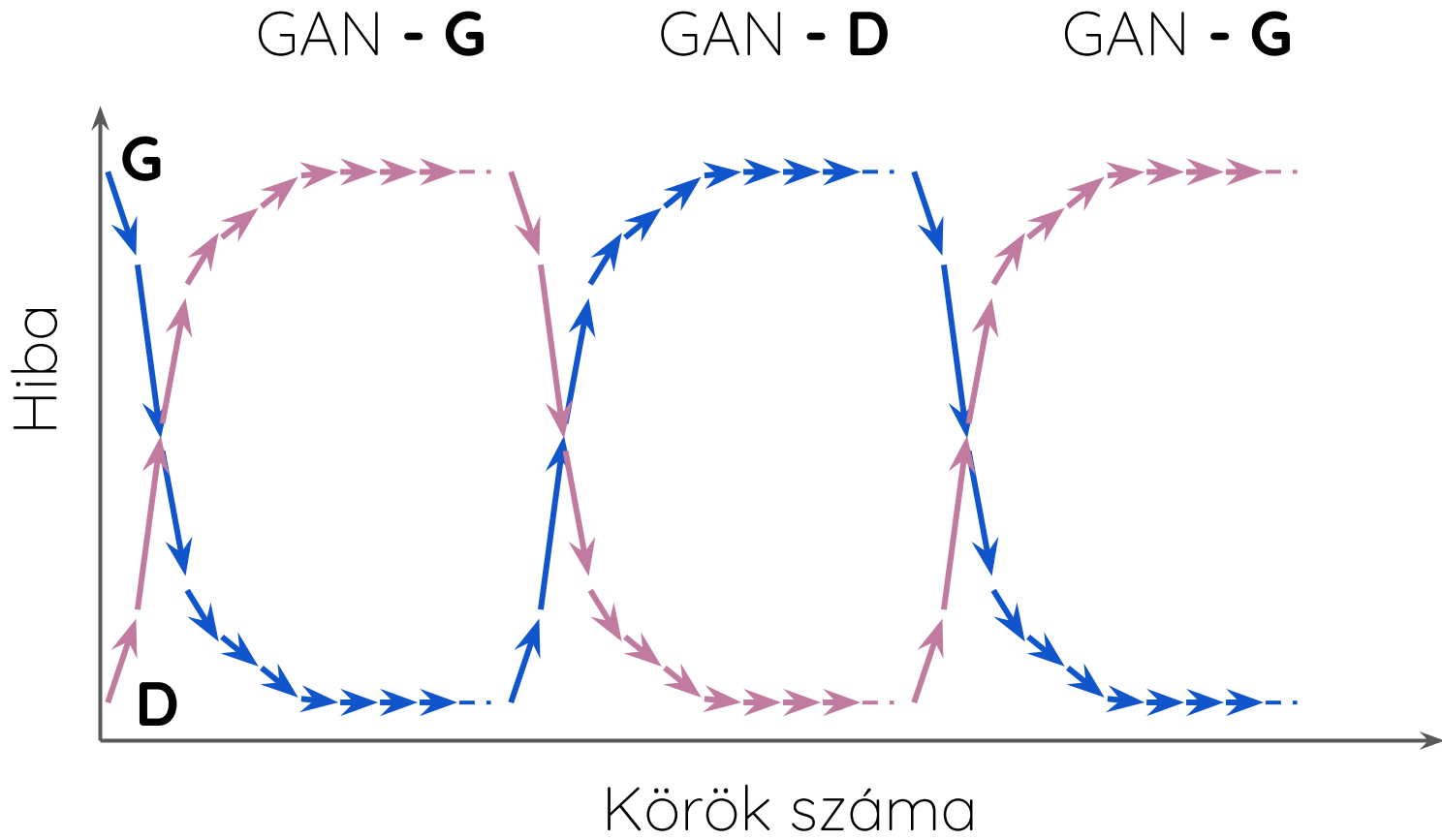
GAN - D...

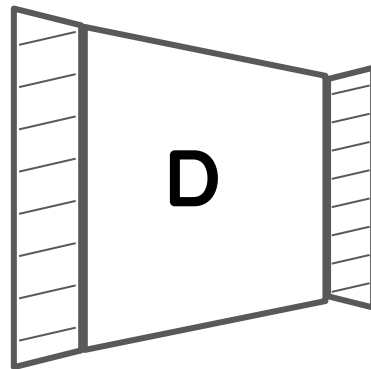
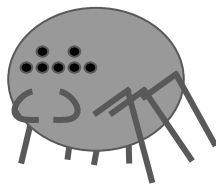
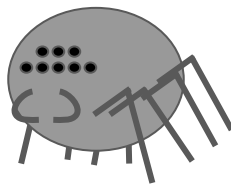
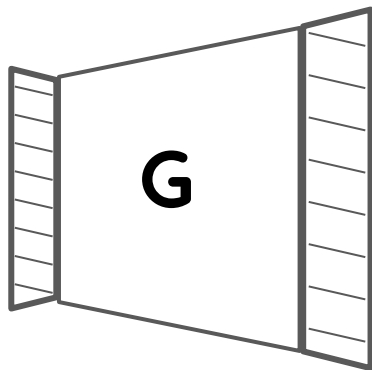


GAN - G

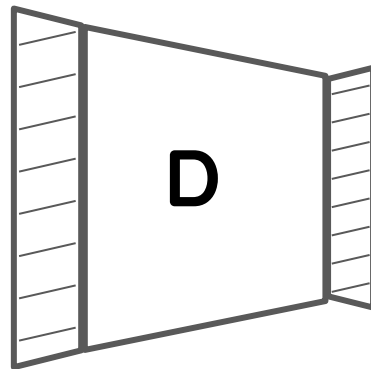
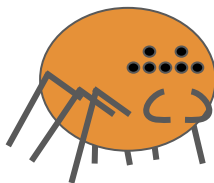
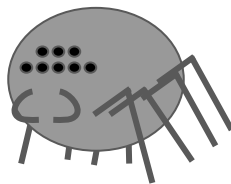
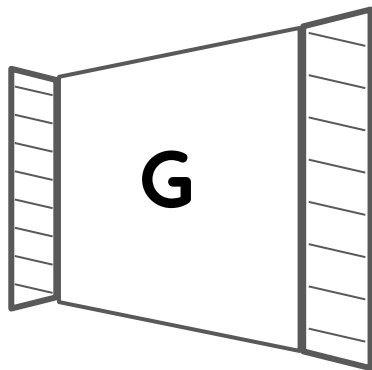
GAN - D





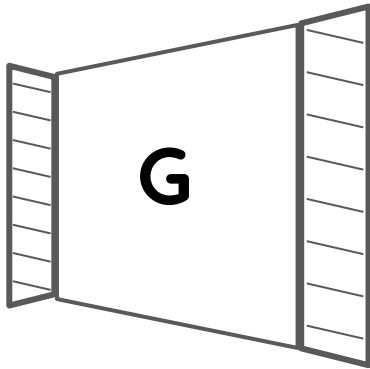
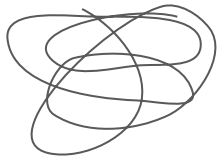
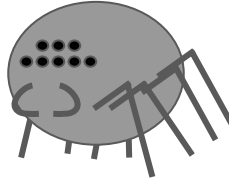


igazi
hamis

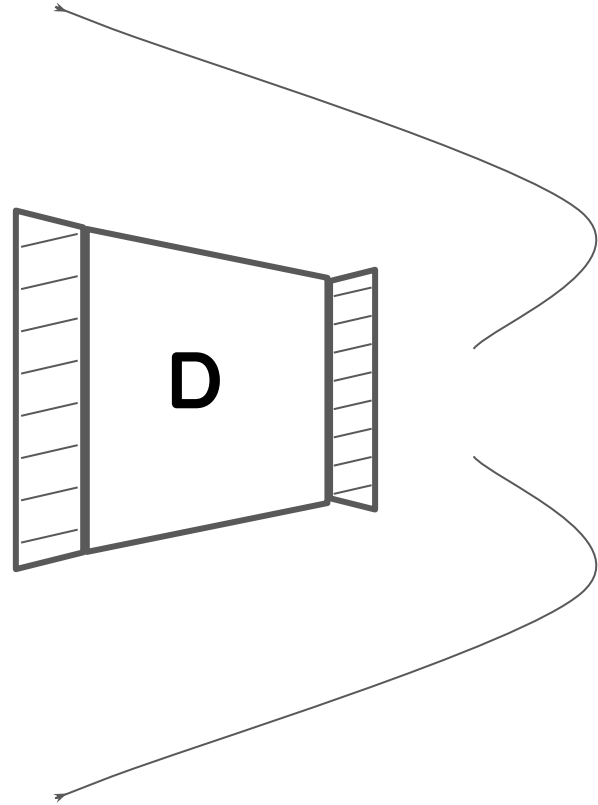


igazi
hamis

igazi



hamis





AI

generates

Fake Faces



smiling
woman



neutral
woman



neutral
man



smiling man

DCGAN - Radford et al.



-



+



=



man
with glasses

man
without glasses

woman
without glasses

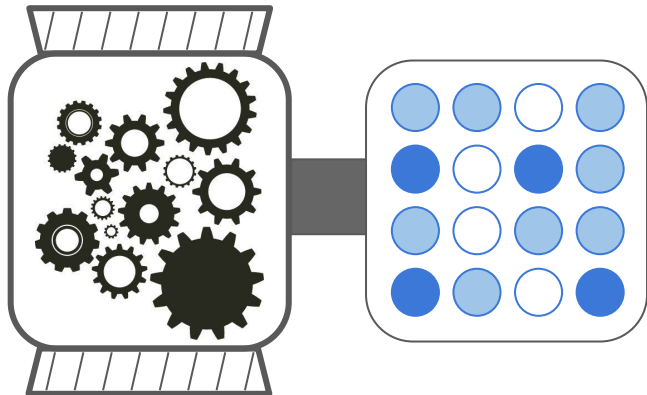
woman with glasses



Results of doing the same arithmetic in pixel space

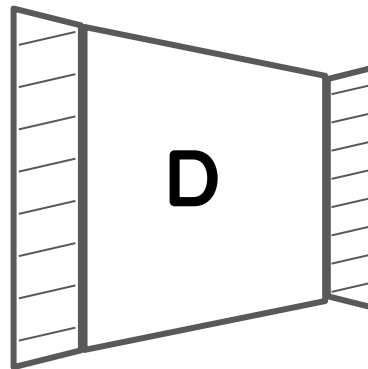
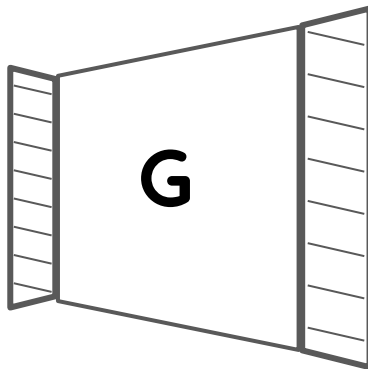






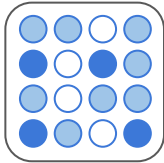
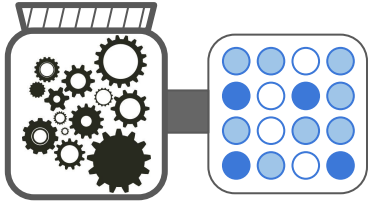
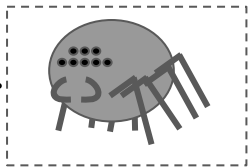
GAN

RNN

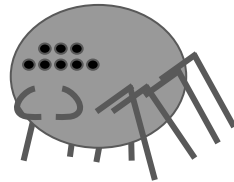


“Egy apró szürke pók”

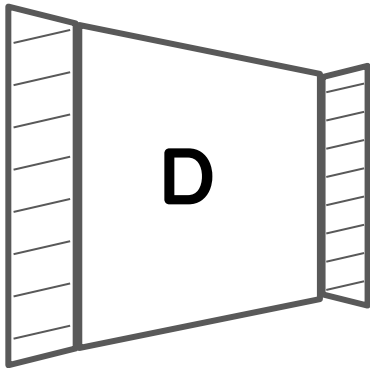
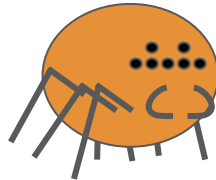
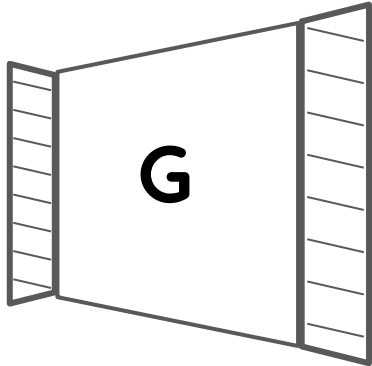
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+



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%



This bird is red and brown in color, with a stubby beak



The bird is short and stubby with yellow on its body



A bird with a medium orange bill white body gray wings and webbed feet



This small black bird has a short, slightly curved bill and long legs



A small bird with varying shades of brown with white under the eyes



A small yellow bird with a black crown and a short black pointed beak



This small bird has a white breast, light grey head, and black wings and tail

Text to Photo - realistic Image Synthesis by Zhang *et al.*

‘Blue bird with black beak’ →
‘Red bird with black beak’



‘Small blue bird with black wings’ →
‘Small yellow bird with black wings’

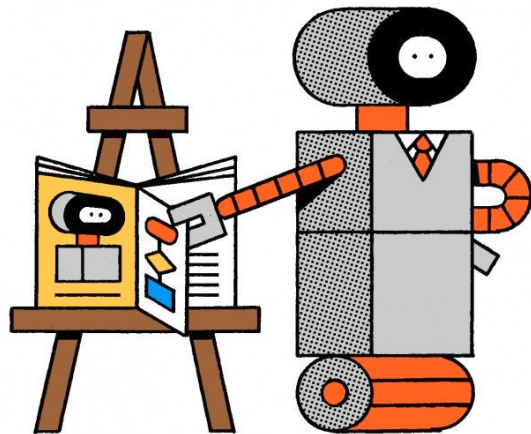


‘This bird is bright.’ → ‘This bird is dark.’

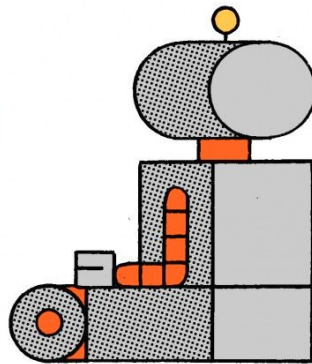


Unsupervised Learning

Szöveg feldolgozás
(RNN)



Kép generálás
(GAN)



Köszönöm

Botos Csaba