



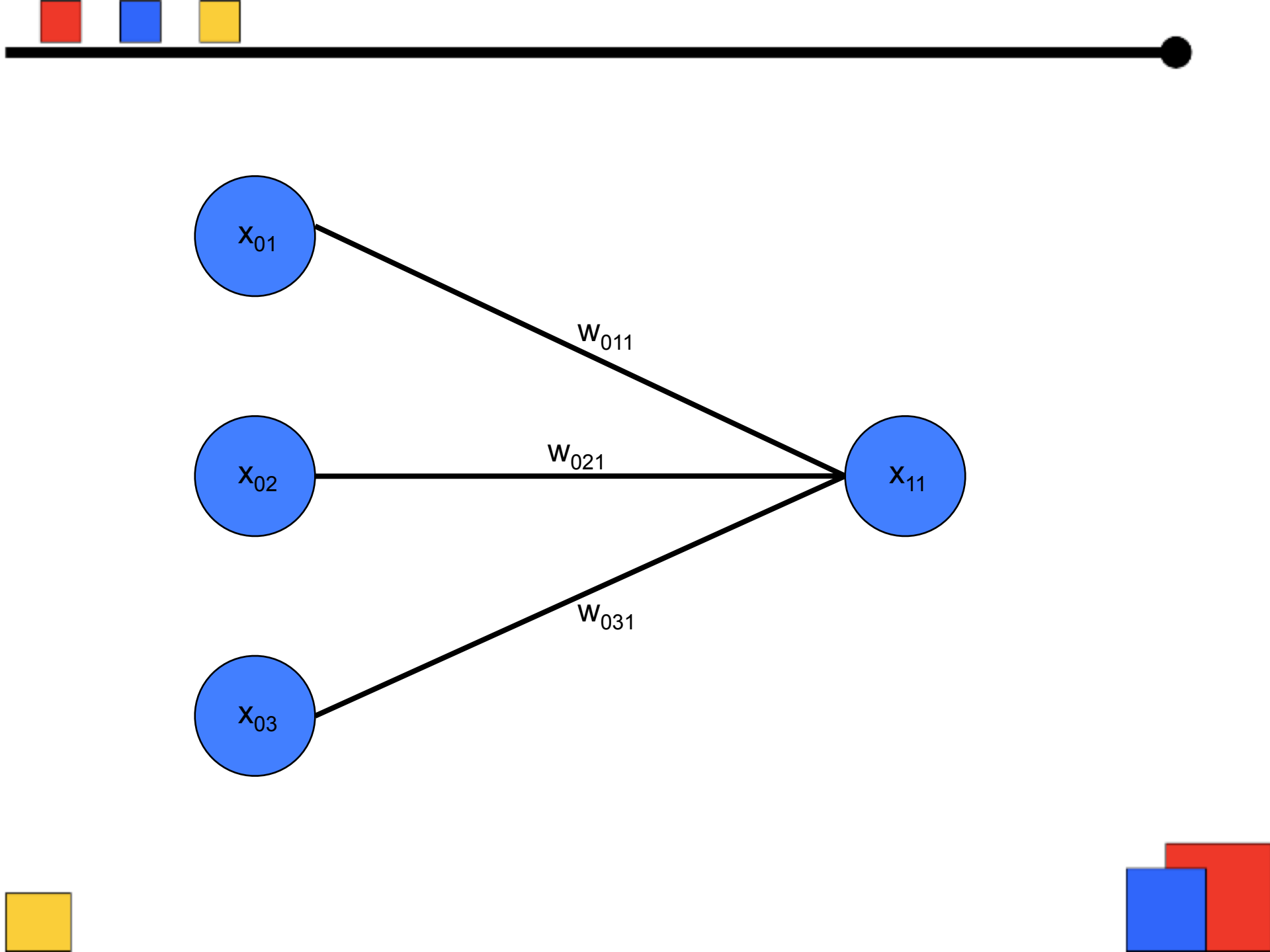
Perceptron

- $f_{\text{act}}(a_1, \dots, a_m) = \text{sig}(a_1, \dots, a_m)$
 - $f_{\text{learn}}(w_{0j1,\text{old}}, d, x_{011} \dots x_{0k}, c) =$
 $w_{0j1,\text{old}} + c * (d - \text{sig}(\sum x_{oi} * w_{oi})) * x_{oi}$
 - $c=0.2$
- 



Perceptron

- Consider a perceptron with 3 input nodes x_{01} , x_{02} and x_{03}
 - $w_{011} = 0.3$, $w_{021} = 0.4$ and $w_{031} = -0.3$
 - Input
 1. $(1, 1, 1) \rightarrow 1$
 2. $(3.2, 1.4, 9.1) \rightarrow -1$
 3. $(8, 7.7, 3.1) \rightarrow -1$
 4. $(1.5, 2.4, 5.5) \rightarrow 1$
- 





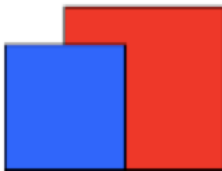
First Data Item

- $w_{011} = 0.3$, $w_{021} = 0.4$ and $w_{031} = -0.3$
 - Input $(1,1,1) \rightarrow 1$
 - $f_{\text{act}} = \text{sig}(1*0.3 + 1*0.4 + 1*-0.3)$
 $= \text{sig}(0.4) = 1$
 - Correct! No change
- 



Second Data Item

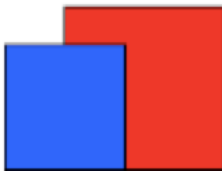
- $w_{011} = 0.3$, $w_{021} = 0.5$ and $w_{031} = -0.3$
 - Input (3.2, 1.4, 9.1) $\rightarrow$ -1
 - $f_{\text{act}} = \text{sig}(3.2 * 0.3 + 1.4 * 0.4 + 9.1 * -0.3)$
 - $= \text{sig}(0.96 + 0.56 + -2.73)$
 - $= \text{sig}(-1.85) = -1$
 - Correct! No change





Third Data Item

- $w_{011} = 0.3$, $w_{021} = 0.4$ and $w_{031} = -0.3$
 - Input (8, 7.7, 3.1) $\rightarrow$ -1
 - $f_{\text{act}} = \text{sig}(8 * 0.3 + 7.7 * 0.4 + 3.1 * -0.3)$
 - $= \text{sig}(2.4 + 3.08 + -0.93)$
 - $= \text{sig}(4.55) = 1$
 - Wrong! Change!





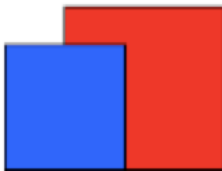
Change the weights

- $W_{011,\text{new}} = 0.3 + 0.2 * -2 * 8 = -2.9$
 - $W_{021,\text{new}} = 0.4 + 0.2 * -2 * 7.7 = -2.58$
 - $W_{031,\text{new}} = -0.3 + 0.2 * -2 * 3.1 = -1.54$
- 



Fourth Data Item

- $w_{011} = -2.9$, $w_{021} = -2.58$ and $w_{031} = -1.54$
 - Input (1.5, 2.4, 5.5) $\rightarrow$ 1
 - $f_{\text{act}} = \text{sig}(1.5 * -2.9 + 2.4 * -2.58 + 5.5 * -1.54)$
 $= \text{sig}(-4.35 + -6.19 + -8.47)$
 $= \text{sig}(-19.01) = -1$
 - Wrong! Change!





Change the weights

- $W_{011,\text{new}} = -2.9 + 0.2 * 2 * 1.5 = -2.3$
 - $W_{021,\text{new}} = -2.58 + 0.2 * 2 * 2.4 = -1.62$
 - $W_{031,\text{new}} = -1.54 + 0.2 * 2 * 5.5 = 0.66$
- 



Begin Again : First Data Item

- $w_{011} = -2.3$, $w_{021} = -1.62$ and $w_{031} = 0.66$
 - Input $(1,1,1) \rightarrow 1$
 - $f_{\text{act}} = \text{sig}(1*-2.3 + 1*-1.62 + 1*0.66)$
 $= \text{sig}(-3.26) = -1$
 - Wrong! Change!
- 



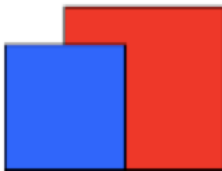
Change the weights

- $W_{011,\text{new}} = -2.3 + 0.2 * 2 * 1 = -1.9$
 - $W_{021,\text{new}} = -1.62 + 0.2 * 2 * 1 = -1.22$
 - $W_{031,\text{new}} = 0.66 + 0.2 * 2 * 1 = 1.06$
- 



Begin Again : Second Data Item

- $w_{011} = -1.9$, $w_{021} = -1.22$ and $w_{031} = 1.06$
 - Input (3.2, 1.4, 9.1) $\rightarrow -1$
 - $f_{\text{act}} = \text{sig}(-1.9*3.2 + -1.22*1.4 + 9.1*1.06)$
 - $= \text{sig}(-6.08 + -1.71 + 9.646)$
 - $= \text{sig}(1.856) = 1$
 - Wrong! Change!





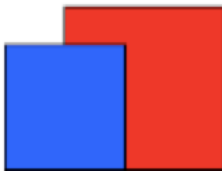
Change the weights

- $W_{011,\text{new}} = -1.9 + 0.2 * -2 * 3.2 = -3.18$
 - $W_{021,\text{new}} = -1.22 + 0.2 * -2 * 1.4 = -1.78$
 - $W_{031,\text{new}} = 1.06 + 0.2 * -2 * 9.1 = -2.58$
- 



Begin Again : Third Data Item

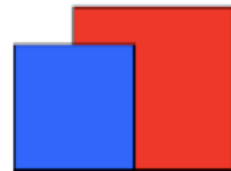
- $w_{011} = -3.18$, $w_{021} = -1.78$ and $w_{031} = -2.58$
 - Input (8, 7.7, 3.1) $\rightarrow -1$
 - $f_{\text{act}} = \text{sig}(8 * -3.18 + 7.7 * -1.78 + 3.1 * -2.58)$
 $= \text{sig}(-25.44 + -13.71 + -8.00)$
 $= \text{sig}(-47.15) = -1$
 - Correct! Don't Change!





Begin Again : Fourth Data Item

- $w_{011} = -3.18$, $w_{021} = -1.78$ and $w_{031} = -2.58$
 - Input (1.5, 2.4, 5.5) $\rightarrow$ 1
 - $f_{\text{act}} = \text{sig}(1.5 * -3.18 + 2.4 * -1.78 + 5.5 * -2.58)$
 $= \text{sig}(-4.77 + -4.27 + -14.19)$
 $= \text{sig}(-23.23) = -1$
 - Wrong! Change!

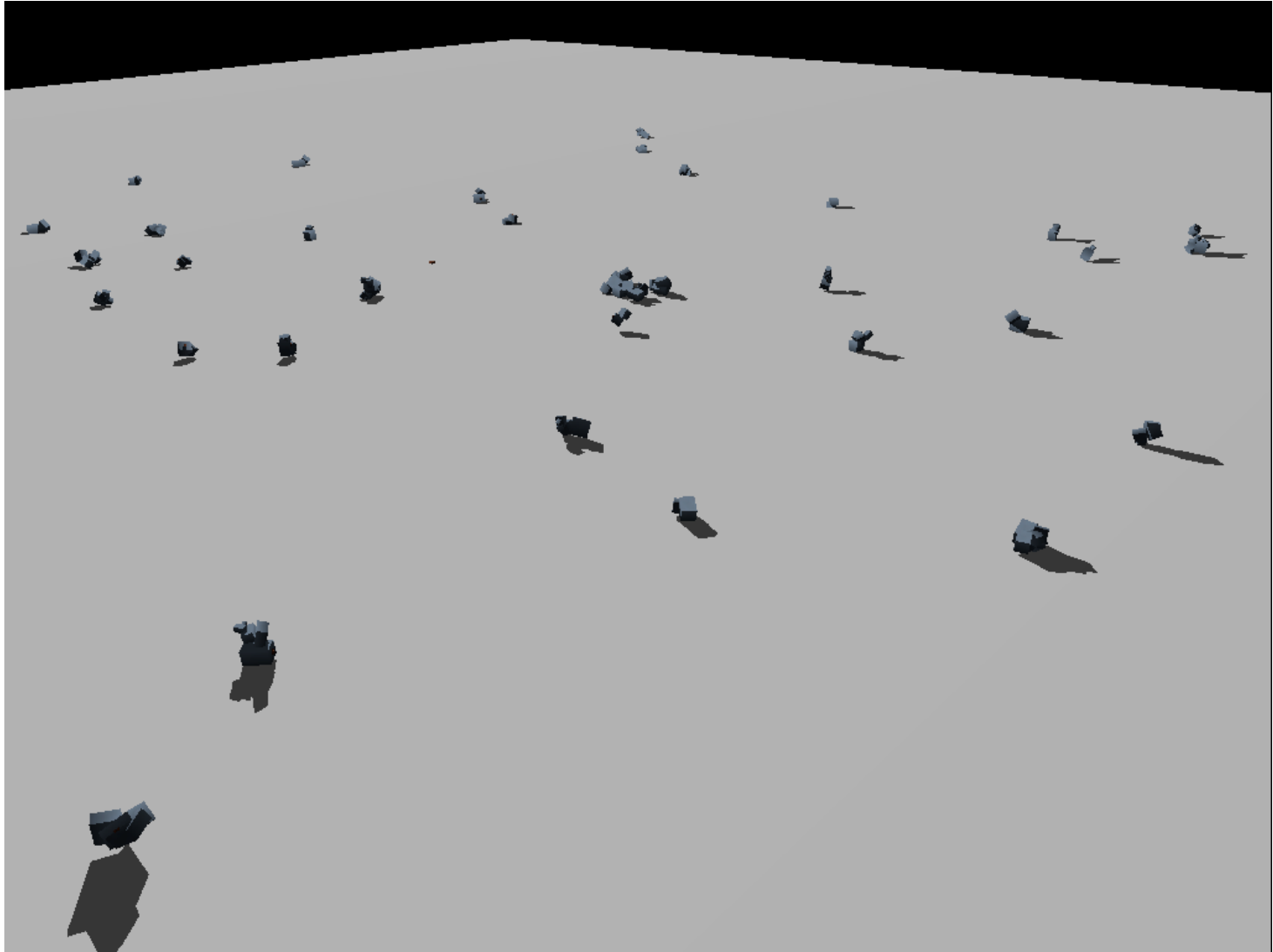




Change the weights

- $W_{011,\text{new}} = -3.18 + 0.2 * 2 * 1.5 = -2.58$
 - $W_{021,\text{new}} = -1.78 + 0.2 * 2 * 2.4 = -0.82$
 - $W_{031,\text{new}} = -2.58 + 0.2 * 2 * 5.5 = -0.38$
- 

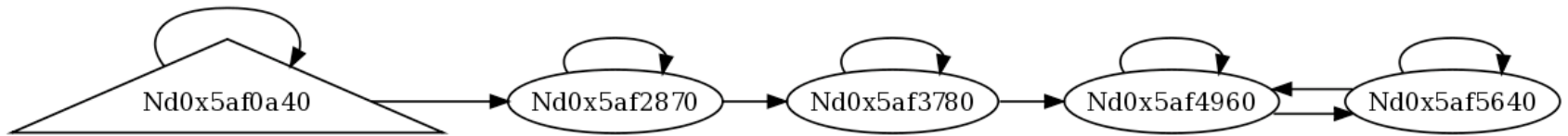
Morphids





Morphids

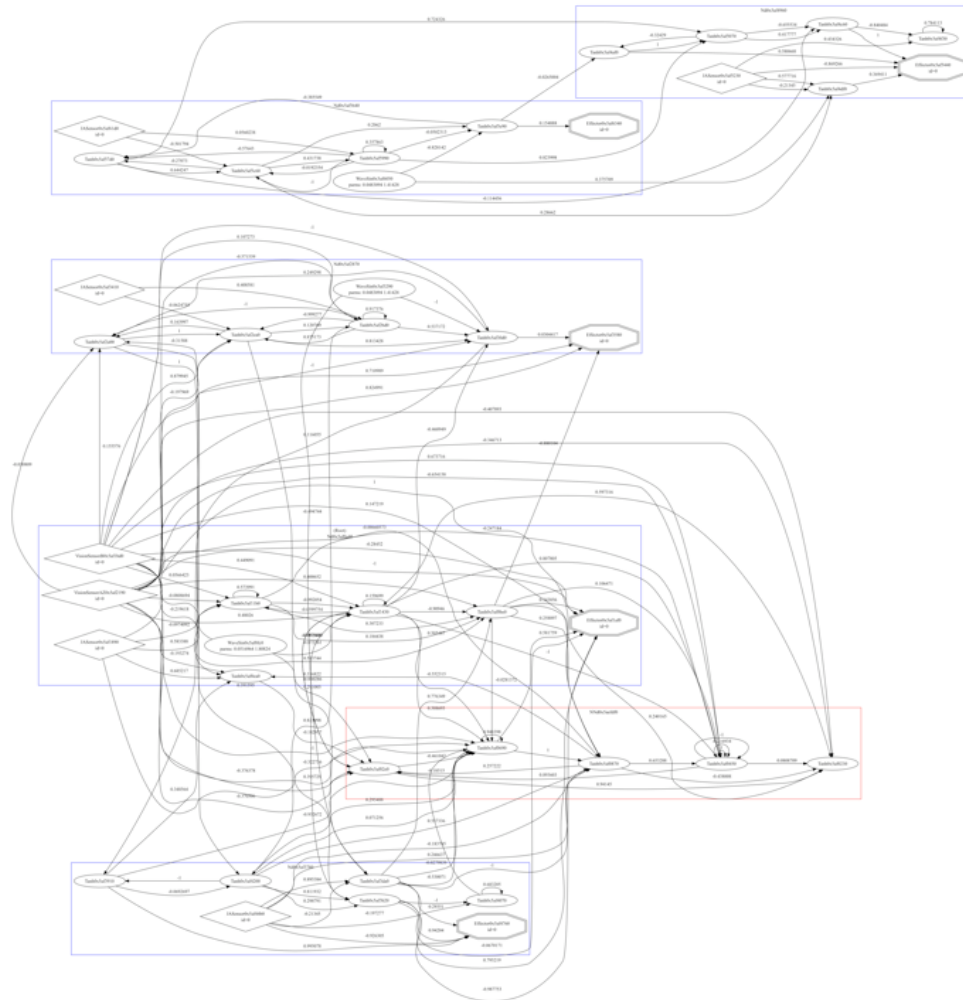
Phenotype



Genotype



Morphids





Morphids

