

## Workspace

Start with a weighted directed graph  $\mathbf{G}$  containing vertices  $v \in \mathbf{V}$  and edges  $e \in \mathbf{E}$ .

We start by defining a weight function for the vertices  $F : \mathbf{V} \rightarrow \mathcal{R}$  with a corresponding weight value  $f_i = F(v_i)$ . Similarly we add a weight for each edge given by the weight function  $W : \mathbf{E} \rightarrow \mathcal{R}$  with corresponding weights  $w_i = W(e_i)$ . Finally, define an activation function on each vertex taking an affine parameter  $\lambda$  as  $\mu[v] : \mathcal{R}x\mathcal{R} \rightarrow \mathcal{R}$ . For simplicity let  $\mu_i(\lambda) := \mu[v_i](\lambda)$ .

Now we can define the potential energy of the system by:

$$\mathcal{E} = \sum_i \left[ f_i - \mu_i\left(\sum_j w_j f_j, \lambda\right) \right]^2 \quad (1)$$