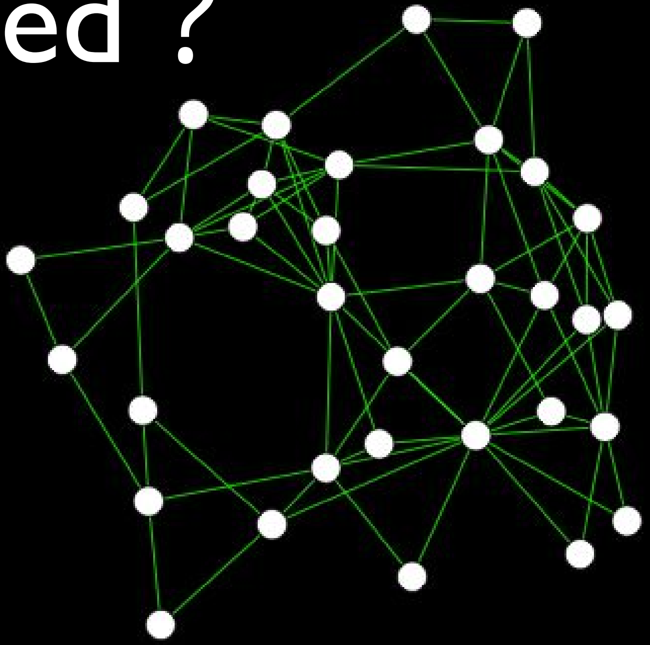
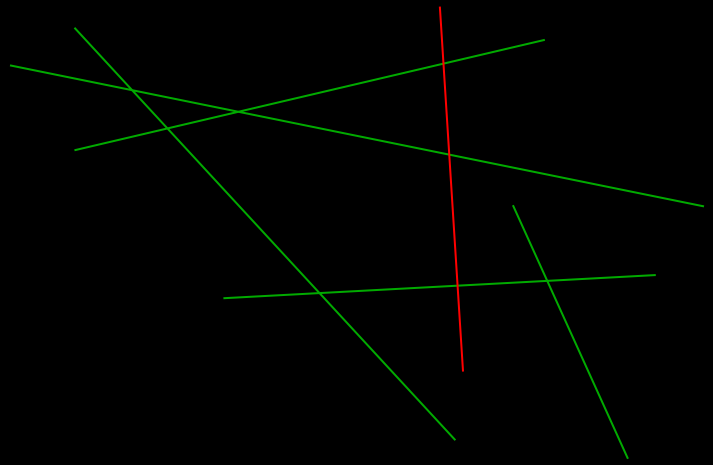
How can human movement be modelled ?

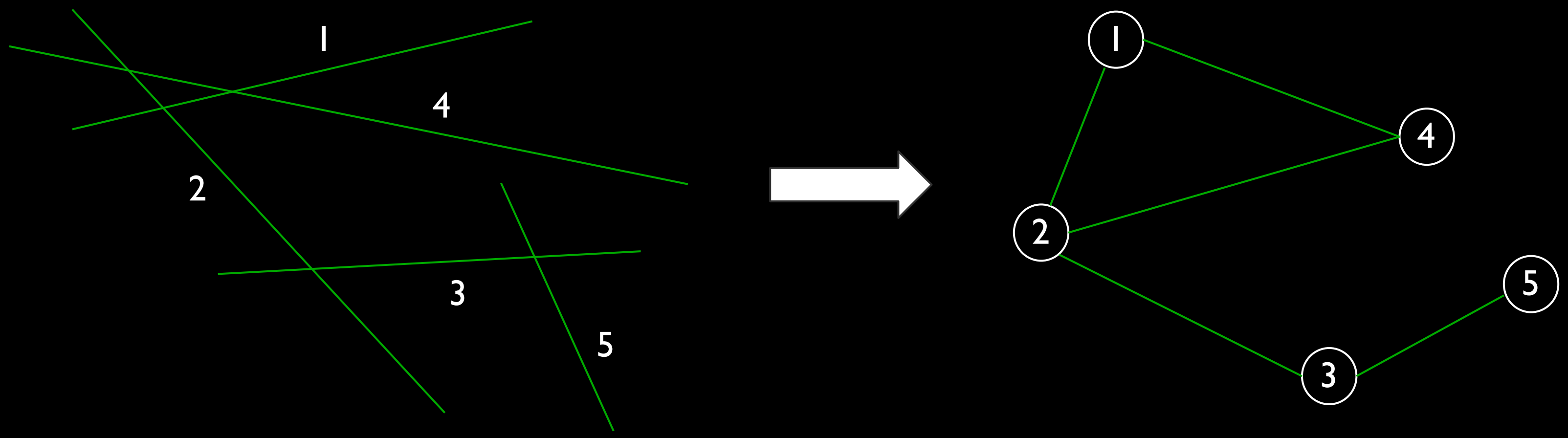


Soma Suzuki

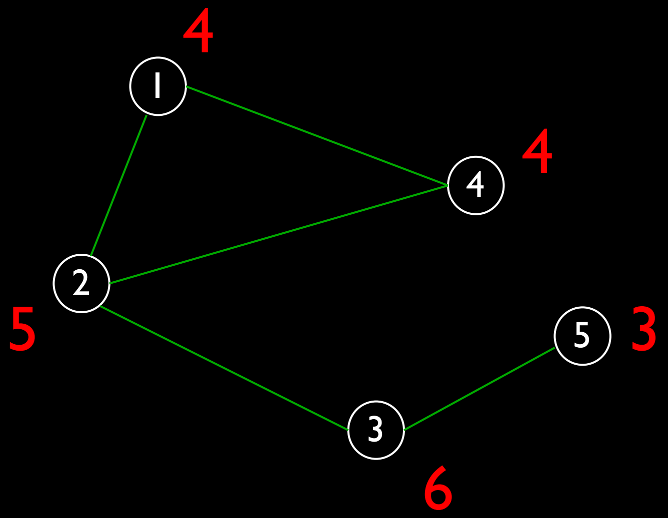
Context



Context



Context

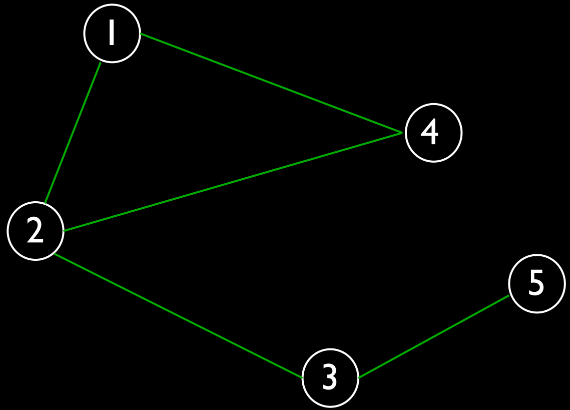


(Jiang '08)

$$\sum_{s=1}^{k} s \times N_s$$

② $3 \times 1 + 1 \times 2 = 5 \quad (if\ s = 2)$

Let's learn from human

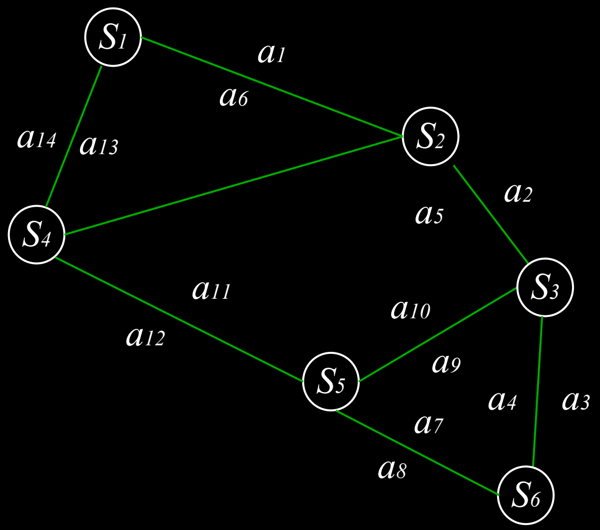


Imitation Learning

Expert trajectory dataset

$$D = \{\zeta_1, \zeta_2 \ldots\ldots \zeta_m\}$$

Markov Decision Process



MDP : tuple (S, A, P, R, Γ)

- $s \in S$: set of states
- $a \in A$: set of actions
- P : state transition matrix
- R_θ : reward function
- $\Gamma \in [0,1]$: discount factor

Maximum Entropy
Inverse Reinfocement Learning

(Ziebart '08)

$D = \{\zeta_1, \zeta_2 \ldots\ldots \zeta_m\}$

$$P_\theta(\zeta) = \frac{1}{Z} exp(R_\theta(\zeta))$$

$$\max_{\theta} \underbrace{\sum_{\zeta \in D} \log P_\theta(\zeta)}_{L(\theta)}$$

Maximum Entropy Inverse Reinfocement Learning

(Ziebart '08)

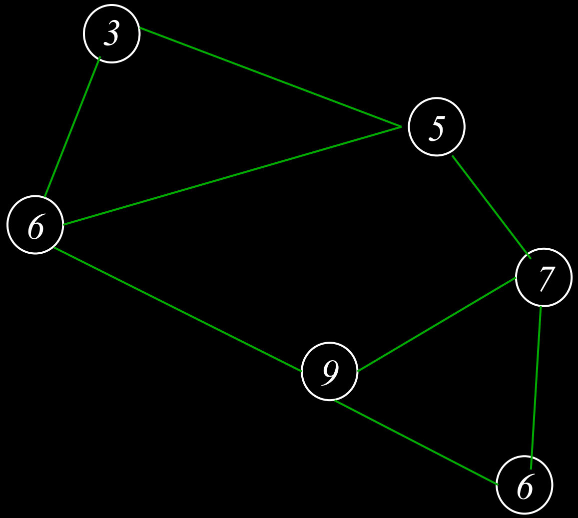
Algorithm

$$
\begin{aligned}
&\theta_0 \leftarrow RewardParameterInitialization \\
&for\ i = 1 : N \\
&\quad R_i \leftarrow UpdateReward(\theta_i) \\
&\quad \pi_i \leftarrow UpdatePolicy(R_i) \\
&\quad P \leftarrow UpdateProbabilityDistribution(\pi_i) \\
&\quad Compute\ \nabla L(\theta) \\
&\quad \theta_0 \leftarrow UpdateRewardParameter(\nabla L(\theta))
\end{aligned}
$$

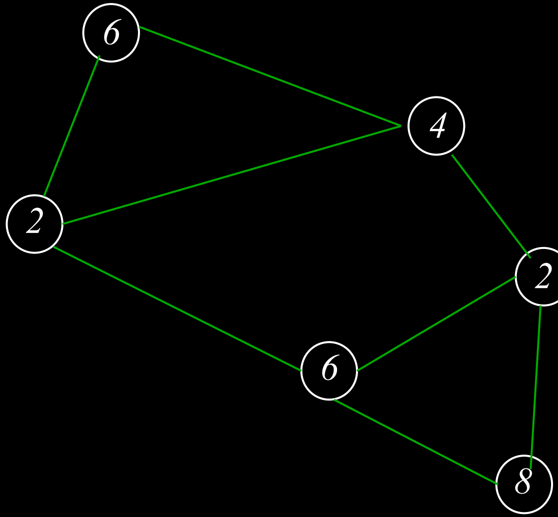
Evaluation

Correlation

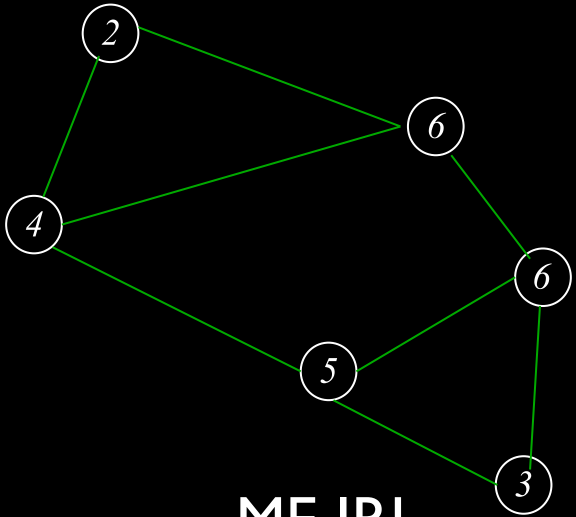
Correlation



Space Syntax



Human Movement



ME IRL

Problem that I need to overcome

Collecting data pertaining to individual walking paths is very challenging (Torrens '10)

Questions?