Speedy Learning

I. Updates

Let Φ be the $|S| \times k$ feature matrix, whose s^{th} row is given by $\phi^\top(s)$. Let the approximate value function be denoted by $\tilde{J} \approx \Phi\theta$ and let v denote an auxilliary variable that esitmates $G = \mathbf{E}[\phi\phi^\top]$ and let $G' = \mathbf{E}[\phi\phi'^\top]$, where ϕ' is the feature of the next state. Let $\delta\theta = r + \gamma\phi'^\top\theta - \phi^\top\theta$ denote the temporal difference. The updates are as below

$$v_{n+1} = v_n + \alpha(n)(\delta\theta) + \gamma\phi\phi'^\top(\theta_n - \theta_{n-1}) \tag{1}$$

$$\theta_{n+1} = v_n - \phi\phi^\top\theta_n. \tag{2}$$