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**Felix Xiao-feng Ye\*** (yexf308@uw.edu), Department of Applied Mathematics, Lewis Hall 202, Box 353925, Seattle, WA 98105. *Rate of exponential forgetting in HMM and its application to statistical learning*. Preliminary report.

We consider a finite state hidden Markov model (HMM) with multidimensional observations. Under some mild assumptions, the prediction filter forgets almost surely the initial condition exponentially fast. However, it is very difficult to calculate this asymptotic rate of exponential loss of memory analytically. We restate this problem in the setting of the random dynamical system and use the Lyapunov exponents of the induced random dynamical system defined in the projective space  $\mathbb{R}^{n-1}$  to approximate the convergence rate. Finally, we propose a stable numerical algorithm to calculate the rate of exponential forgetting semi-analytically. The numerical simulation result and comparison with current upper bound in literature will be shown in the presentation.

We harness this memory forgetting property to design an algorithm for efficiently estimating the gradient of log-likelihood, such that it speeds up the gradient based numerical optimization. Examples are shown in the presentation compared with traditional methods. (Received August 29, 2017)