In this section we give detailed descibtion of every notation used in table 1.

GTD2 convergence analysis resutls are taken from **?**. The learning rate required for their guarantee to work is set to $\frac{9^2\times 2\sigma}{8\sigma^2(k+2)+9^2\zeta}$ and complexity to obtain accuracy ϵ is $\mathcal{O}(\frac{\kappa(Q)^2\mathcal{H}d}{\lambda_{\min}(G)\epsilon})$. In this notation:

- σ is the minimum eigenvalue of matrix $A^TM^{-1}A$, where matrix $M = \mathbb{E}[\phi(s_k,a_k)\phi(s_k,a_k)^T]$ and $A = \mathbb{E}[e_k(\gamma\mathbb{E}_\pi[\phi(s_{k+1},.] - \phi(s_k,a_k))^T]$, where e_k is eligibility trace vector $e_k = \lambda\gamma\kappa(s_k,a_k)e_{k-1} + \phi(s_k,a_k)$.
- k is an iteration number
- Matrix G plays key role in their analysis, it is blok matrix of the form

$$G = \begin{pmatrix} 0 & \sqrt{\beta}A^T \\ -\sqrt{\beta}A & \beta M_k \end{pmatrix}$$

  and G_k is a matrix of similar form generated from quantities estimated at time point k.
- ζ is $2\times 9^2c(M)^2\rho^2 + 32c(M)L_G$, where $c(M)$ is the condition number of matrix M, ρ is the maximum eigenvalue of matrix $A^TM^{-1}A$ and L_G is the $L_G = ||\mathbb{E}[G_K^TG_K|\mathcal{F}_{k-1}]||$. $\mathcal{F}_{k-1}$ in this analysis is sigma algebra generated but all previous history up to moment $k-1$.
- Quantity $\mathcal{H}$ is equal to $\mathbb{E}||G_Kz^* - g_k||$, where $z^* = (\theta^*, \frac{1}{\sqrt{\beta}w*})$ is the optimal solution and $g_k = (0, \frac{1}{\sqrt{\beta}}b)$
- the last quantity left undefined is $\kappa(Q)$, which is the condition number of matrix Q, obtained by diagonalization of matrix $G = Q^T\Lambda Q$.

PD SVRG and **PD SAGA** use the same quantities as **GTD2**, except that matrices A and C are defined the same way as in this paper: $A = \mathbb{E}[(\phi(s)^T\theta - \gamma\phi(s')^T\theta)\phi(s)]$, $C = \mathbb{E}[\phi(s)\phi^T(s)]$.

- n in this notation is the size of the dataset.
- μ_ρ is the minimum eigenvalue of matrix $A^TC^{-1}A$

All other quantities are defined in the paper.