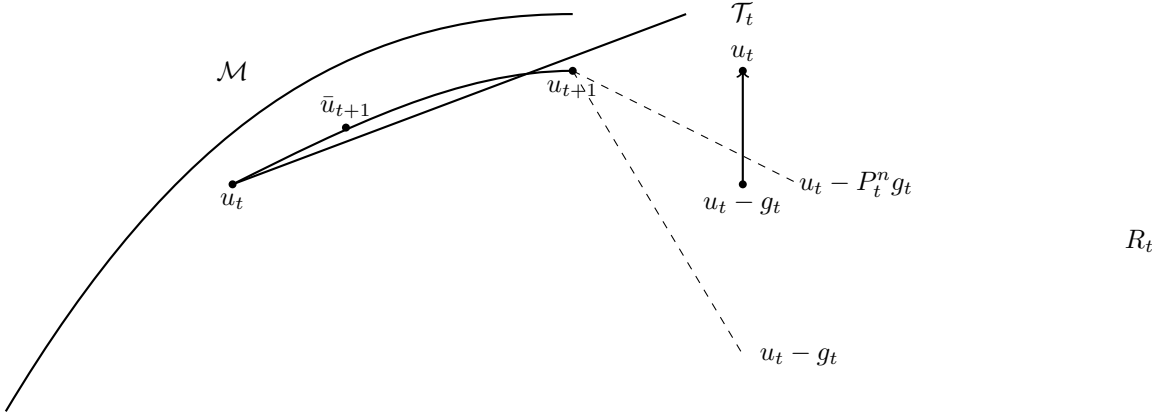

Figure 1: Illustration of the proposed algorithm: based on an iterate $u_t \in \mathcal{M}$ and the choice of a linear space $\mathcal{T}_t$, an approximation $P_t^n g_t \in \mathcal{T}_t$ of the true gradient g_t is first obtained via a random operator P_t^n. Then an update $\bar{u}_{t+1} = u_t - s_t P_t^n g_t$ is obtained given a step size s_t. Then, the next iterate $u_{t+1} \in \mathcal{M}$ is obtained through application of the retraction map R_t.