Deep Q-Networks for Event Summarization

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Event Summarization

$$\hat{\boldsymbol{\beta}}_{ridge} = argmin_{\beta}(\boldsymbol{y} - \boldsymbol{x}^T\boldsymbol{\beta})^2 + \boldsymbol{\lambda}\boldsymbol{\beta}^2 \tag{1}$$

- First published by the Russian Mathematician Andrey Nikolayevich Tikhonov (1906-1993) in 1943

Policy

- A policy takes as input a state and a set of possible actions and returns the optimal state
- The policy can be deterministic or probabilistic

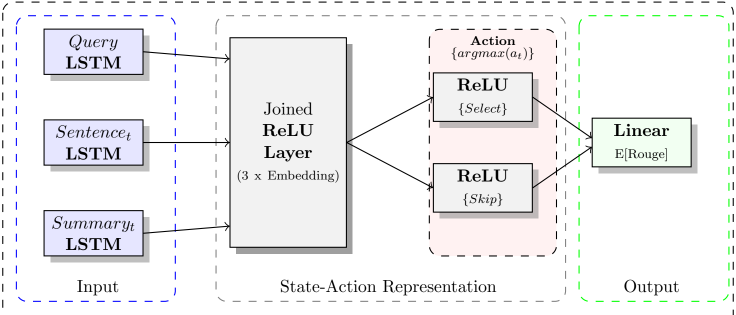

Figure 1: DQN-LSTM Architecture

DQN-LSTM for Event Summarization Training Procedure

Input: $\{\mathcal{D}$: Event queries, X_d: Input sentences, N: Number of epochs$\}$
Output: $\{\hat{Q}$: extraction policy, $\tilde{Y}_d$: event summary for query $d\}$

Initialize extraction policy $\hat{Q}$ with random weights
Initialize memory and summary: $\Gamma, \tilde{Y} = \{\emptyset\}_{d=1}^{|\mathcal{D}|}, \{\emptyset\}_{d=1}^{|\mathcal{D}|}$
for $epoch = 1, .., N$ **do**
  for query $d \in \mathcal{D}$ **do**
    $X_d, \tilde{Y}_d = \{\text{Extract } t = 1, ..., T_d \ (sentences_d,\ summary_d)\}$
    for $x_t, \tilde{y}_t \in X_d, \tilde{Y}_d$ **do**
      Set $s_t = s(x_t, \tilde{y}_t, d)$
      $\forall a_t \in \mathcal{A}(s_t)$ compute $\hat{Q}(s_t, a_t)$ and select $a_t^* = \text{argmax}_{a_t} \hat{Q}(s_t, a_t)$
      if $random() < \epsilon$ **then** select a_t^* at random with $\Pr(a_t) = \frac{1}{|\mathcal{A}|}$
      Update $\tilde{y}_{t+1}$ according to equation (1)
      Execute action a_t^* and observe reward r_t and new state s_{t+1}
      Update $\Gamma_d = \Gamma_d \cup \{[s_t, a_t^*, r_t, s_{t+1}]\}$
  for $j = 1, ..., J$ transitions sampled from Γ **do**

$$\text{Set } y_j = \begin{cases} r_j & \text{if } s_{j+1} \text{ is terminal} \\ r_j + \gamma \max_{a'} \hat{Q}(s_{j+1}, a'; \theta) & \text{if } s_{j+1} \text{ is non-terminal} \end{cases}$$

    Perform gradient step on $\mathcal{L}(\theta) = (y_j - \hat{Q}(s_j, a_j; \theta))^2$

Useful Links below

Thank you

- GitHub