

Using Deep-Q Network To Select Candidate From N-best Speech Recognition Hypotheses For Enhancing Dialogue State Tracking

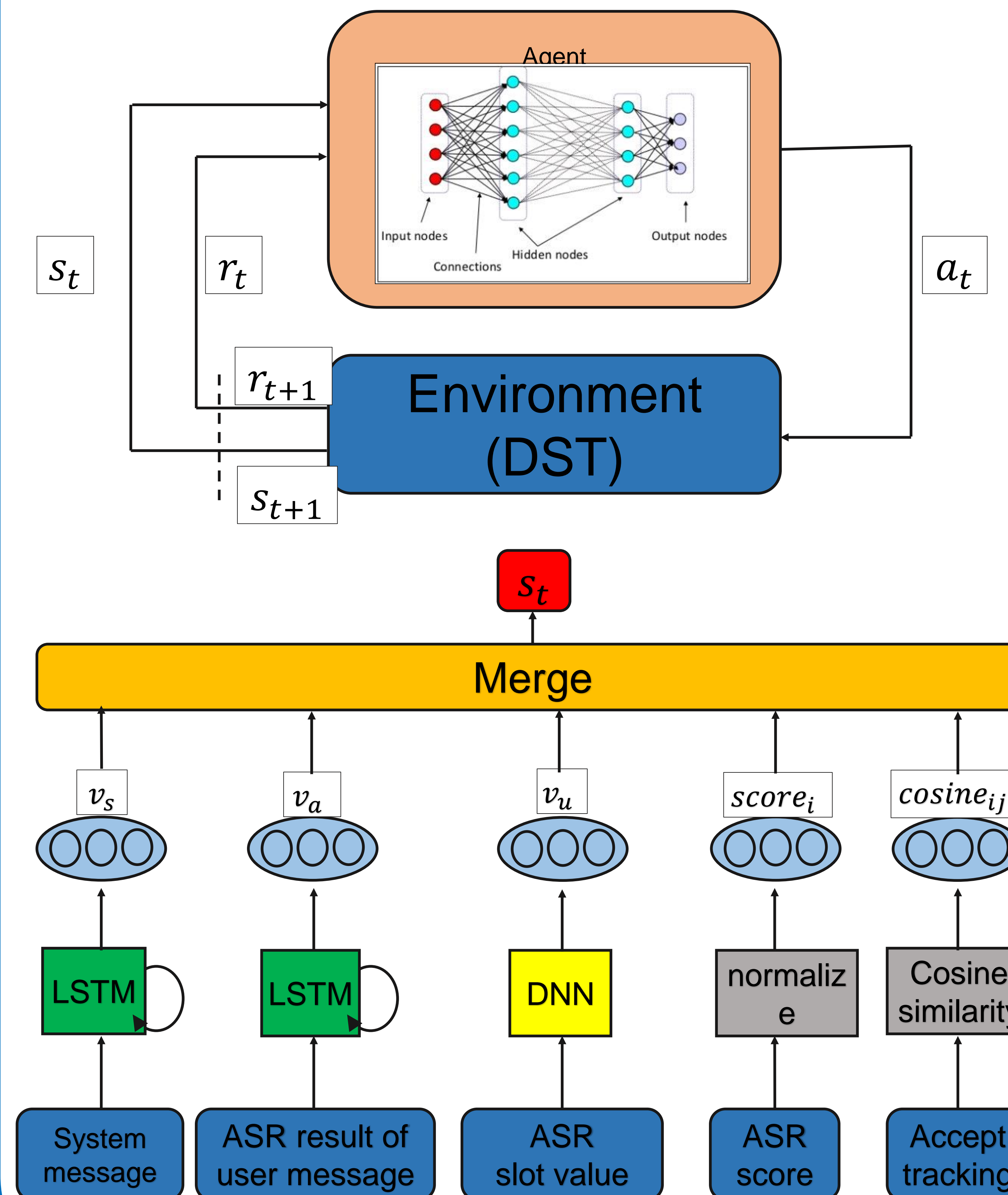
Introduction

- In certain noisy environments, the best transcription is often imperfect, severely influencing DST accuracy and possibly causing the dialogue system to stall or loop. The missed or misrecognized words can often be found in the runner-up candidate transcriptions from 2 to n, which could be used to improve accuracy of DST.
- We propose a novel approach to automatically determine the optimal time to stop reexamining runner-up ASR transcriptions based on deep reinforcement learning.
- Our method outperforms the baseline system, which uses only the top-1 ASR result, by 3.1%. Then, we select the dialogue rounds with the top-10 largest word error rate (WER), our method can improve DST accuracy by 15.4%

Action & Reward

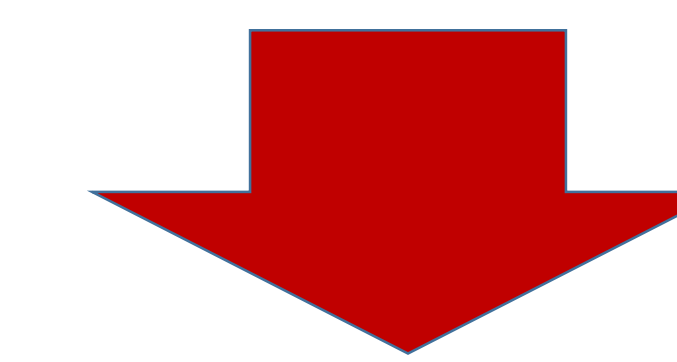
- Action :
 - Accept and proceed
 - Accept and stop
 - Discard and proceed
 - Discard and stop
- Reward :
 - If at least one ASR result is selected in this round, we reward the system with the DST accuracy [0 -1].
 - If no ASR result is selected in this round, the reward is -1. Actions taken prior to the final action in a selection round are always given a reward of zero.

Architecture



Result

System : Hello, welcome to the Cambridge restaurant system?.....	
➤ ASR-1 : restaurant	Accept
➤ ASR-2 : expensive expensive	Accept
➤ ASR-3 : a restaurant	Discard
System : What kind of food would you like?	
➤ ASR-1 : don't care	Accept
➤ ASR-2 : don't here	Discard
➤ ASR-3 : I don't care	Accept



Agent select important ASR candidate for DST

System : Hello, welcome to the Cambridge restaurant system?.....	
➤ ASR-1 : restaurant	
System : Hello, welcome to the Cambridge restaurant system?.....	
➤ ASR-2 : expensive expensive	
System : What kind of food would you like?	
➤ ASR-1 : don't care	
System : What kind of food would you like?	
➤ ASR-3 : I don't care	

Performance

	Dev	Test
Baseline	50.59%	59.68%
DDQN +score	54.8%	64.0%
DDQN +Slot	55.0%	65.7%

	Top-N largest WER utterances		
	N = 10%	N = 20%	N = 30%
Baseline	47.7%	51.0%	54.2%
Our Method	63.1%	57.6%	54.7%