Internship at Laboratoire Informatique d'Avignon (LIA), France

How hidden states manage memory in Recurrent Neural Networks ?

Advisors: Mohamed Morchid and Georges Linarès

Recurrent Neural Networks (RNN)[1] receive an important interest from Artificial Intelligence researches (AI) this last decade due to their high capability to learn complex internal structures to expose relevant information. However, RNNs fail to reveal long-term dependencies and new RNN with gates have been proposed to address this drawback such as Long Short- Term Memory (LSTM) or "Gated Recurrent Unit" has been introduced.

In these recurrent neural networks[1][2][3][4], eahc hidden basic unit manages alnongside long- and short-term dependencies during the recurrent process to learn latent relations between intput features throughout different timesteps. Nonetheless, inter-dependencies between short and long sequences have underlined the importance of understanding how hidden states retain most of the relevant information in the latent space to better and fatser code these internal dependencies.

The aim of the internship is to:

– first **study** the behavior of the hidden states of different state-of-the-art recurrent neural networks to exhibit the memory process in the latent space of the hidden inter-dependcencies between sequences in different timestep.
– Then, **novel architectures** that consider these intern dependencies during the learning will be modeled and developped throughout the PyTorch framework[5].
– These novel frameworks will be **evaluated** in different real-life natural langage processing related tasks such as theme and mention identification task of spoken dialogues[3], langage modeling[6] and automatic speech recognition[5].

Required skills: neural networks, python, linear algebra (plus), english speaking and writing skills.

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Duration: 6 mounths
Salary: 529 euros/mounth

Références

[1] Graves, Alex and Mohamed, Abdel-rahman and Hinton, Geoffrey, ''*Speech recognition with deep recurrent neural networks*'', in IEEE international conference on Acoustics, speech and signal processing (icassp), 2013.
[2] Mohamed Morchid. "*Parsimonious memory unit for recurrent neural networks with application to natural language" processing* In Ineurocomputingn, vol. 314, pp48—64, 2018.
[3] Mohamed Morchid, "*Internal Memory Gate for Recurrent Neural Networks with Application to Spoken Language Understanding*", In Interspeech 2017
[4] Mohamed Bouaziz, Mohamed Morchid, Richard Dufour, Georges Linarès et Renato De Mori, "*Parallel Long Short-Term Memory for Multi-Stream Classification*", in SLT 2016
[5] Titouan Parcollet, Ying Zhang, Mohamed Morchid, Chiheb Trabelsi, Georges Linarès, Renato De Mori et Yoshua Bengio, "Quaternion Convolutional Neural Networks for End-to-End Automatic Speech Recognition", in InterSpeech 2018
[6] Mikolov, Toms and Karafiat, Martin and Burget, Lukas and Cernocky, Jan and Khudanpur, Sanjeev, "*Recurrent neural network based language model*", Interspeech 2010