Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

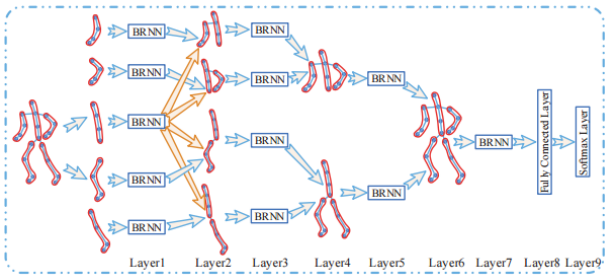
Advanced Interactive Technologies

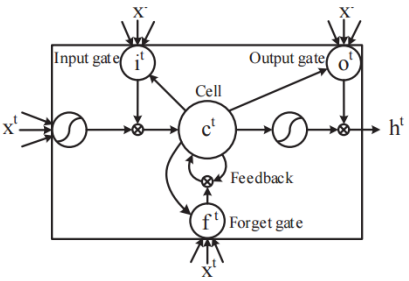
Recurrent Neural Network for Skeleton Based Action Recognition

Project description

Human actions can be represented by the trajectories of skeleton joints. Traditional methods generally model the spatial structure and temporal dynamics of human skeleton with hand-crafted features and recognize human actions by well-designed classifiers. For this project, considering that recurrent neural network (RNN) can model the long-term contextual information of temporal sequences well, we aim to explore an end-to-end hierarchical RNN for skeleton based action recognition.
A **recurrent neural network** (**RNN**) is a class of artificial neural network where connections between units form a directed cycle. This creates an internal state of the network which allows it to exhibit dynamic temporal behavior. Unlike feedforward neural networks, RNNs can use their internal memory to process arbitrary sequences of inputs. This makes them applicable to tasks such as unsegmented connected dynamic action recognition such as handwriting recognition, where they have achieved the best known results.

In this project, the ***main challenge*** is to explore how to design a suitable RNN framework for human joints data. (That is, **how to represent the body by parts, how many layers of NN to use, what kind of layers(BRNN or RNN) to use and how to combine them** and so on)
We will evaluate our model on three benchmark datasets: MSR Action3D Dataset, Berkeley Multimodal Human Action Dataset (Berkeley MHAD), and Motion Capture Dataset HDM05.





Key words

RNN, Skeleton, Action recognition, Benchmarks

Work packages

- Literature on RNN and RNN for human action recognition (http://www.cvfoundation.org/openaccess/content_cvpr_2015/papers/Du_Hierarchical_Recurrent_Neural_2015_CVPR_paper.pdf, http://deeplearning.cs.cmu.edu/pdfs/Hochreiter97_lstm.pdf,)

- Explore and implement suitable structure of RNN for skeleton based action recognition
- Evaluate your algorithm on benchmark datasets
- Bonus: Adapt your algorithm into GPU implementation for real-time testing

Required skills

- Good C or python skills,
- Good knowledge in machine learning and computer vision
- Highly motivated and independent

Type	SA/MA
Partner	
Time period	Autumn 2015
Student(s)	
Internal supervisor(s)	Jie Song, jsong@inf.ethz.ch, Otmar Hilliges, otmar.hilliges@inf.ethz.ch,

ETH
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Formal Requirements

Work schedule: Please provide your supervisor a work schedule *within two weeks* after the start of the project. Generally, Bachelor and Semester projects last 14 weeks starting at the first day of the semester and end at the end of the semester. Master projects last 6 months and the starting date is agreed on with the supervisor.

Intermediate presentation: An informal intermediate presentation (about 10 minutes presentation/discussion) about your work will take place around mid-term. The goal of the presentation is to give a brief summary of the work done, to propose a plan for the continuation of the project, and to discuss about the main directions of the project.

Final presentation: The final presentation will take place at the end of the project. A test run is presented to and discussed with the supervisors 2–5 days before the public final presentation. *Exact dates and times for the intermediate and final presentations will be arranged by the lab administration.*

Report: A report has to be handed in to the responsible supervisor. The report has to describe the full work performed during the whole project. A preliminary version has to be handed in *one week after the final presentation or as determined with the supervisor*. The preliminary version of the report is discussed with the supervisors. The final report has to be handed over to the responsible supervisor in *3 paper copies*. All documents and files, including the report (original data and as a PDF-file) and the final presentation, have to be saved on a CD/DVD and handed in together with the final report.

Evaluation: The project is assessed according to the AIT evaluation sheet and the "Merkblatt für Studierende zum Thema Plagiate" of ETH Zurich. The responsible supervisor hands both of them out at project start. The final presentation is evaluated based on the public final presentation. The report is evaluated based on the preliminary version with the requirement that the remarks are incorporated in the final report.

Plagiarism: Every student has to make himself/herself familiar with ETH Zurich rules regarding plagiarism.
http://www.ethz.ch/faculty/exams/plagiarism/index_EN

Duration of Final Presentations:

- Bachelor and Semester projects: 15 minutes presentation, 5 minutes questions / discussion
- Semester/Bachelor Project with integrated SoM: 22 minutes presentation, 8 minutes questions / discussion
- Master projects: 20 minutes presentation, 10 minutes questions / discussion

Responsible Professor	Responsible Supervisor	Student
Signature	Signature	Signature

Zurich, Date: _____.

Notes

The internet provides detailed information on how to write a scientific report and how to make a presentation. The report and presentation should be done according to these common guidelines and the instructions from your supervisors. We recommend reading the following instructions before you start with your work:

- *Writing Guidelines for Engineering and Science Students*
  http://www.writing.eng.vt.edu/
- *Prof. Bernstein's Student Guides*
  http://aerospace.engin.umich.edu/people/faculty/bernstein/guide.html

The style and format of your report should follow common practices and the instructions of your supervisors. However, the ETH template is preferred for the presentation. We recommend you using Microsoft Office, OpenOffice or LaTeX to create your report and presentation. Please ask your supervisor for the template files.

Report

- Podlubny and Kassayova, *Authoring Scientific and Technical Documents with Microsoft Word 2000*, International Science Publishing, January 2001.
- Oetiker et al., *The Not So Short Introduction to LaTex 2e*, May 2006.
  http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf
- Latex Editor
  http://www.toolscenter.org/ or http://www.lyx.org/

Presentation

- Tufte, *PowerPoint is Evil*, WIRED, September 2003.
  http://www.wired.com/wired/archive/11.09/ppt2.html
- *The LaTeX Beamer Class*
  http://latex-beamer.sourceforge.net/