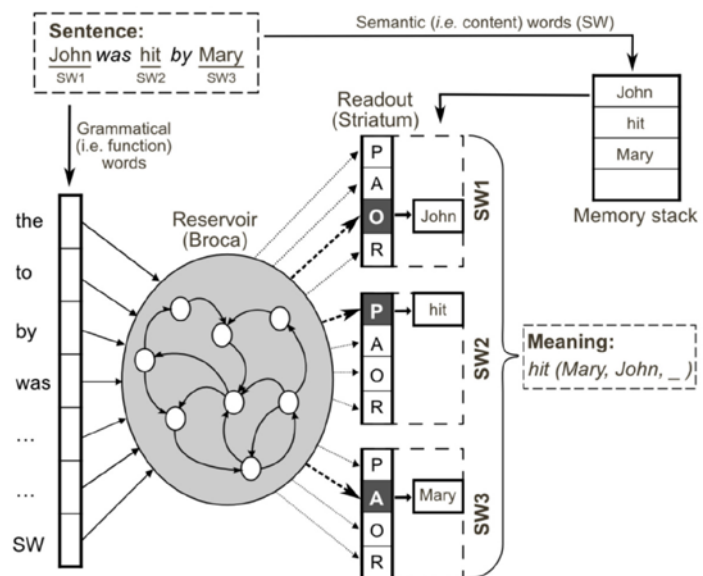


How children learn languages? Recurrent Neural Networks to enable robots to learn (any) language!

Bachelor / Master Thesis

Based on a previously developed neural language model [1-4], the "EchoRob" (Echo State Networks for Developing Language Robots) project aims at teaching different languages to robots using Recurrent Neural Networks (namely, Echo State Networks, ESN).

The general aim has two sub-goals: (1) provide the ability to usual (non-programming) users to teach language to robots, and (2) to give insights on how children acquire language.



In order to collect a significant amount of data in several languages we want to develop a crowdsourcing website where anyone could help us in this research project. Getting inspiration from the famous experiments of the talking heads [5] people would (1) control a real/simulated robot and perform some actions, and would (2) provide description related to the robot actions another user did (i.e. give commands that would make the robot redo the same actions). The collected data would be then used to train the system and enable usual users to give commands to the robot using only natural language.

There is 3 potential bachelor/master projects available for bachelor/master students : "Crowdsourcing website", "Phoneme and language processing in different languages", and "Remote robot control".

Crowdsourcing website

Goals

- We plan to create a crowdsourcing website to enable thousands of users across the world to (1) control a simulated/real Nao robot, and (2) teach it potentially any language.
- Designing a good Crowdsourcing website is not easy, ensuring the good quality and long term participation of people is essential (for instance with scoring like in a game, and by permitting each user to "evaluate" the responses of others, ...). This is a challenging task with room for creative ideas.

Useful skills

- Interest in crowd-based resources.
- Website tools and languages (HTML, PHP, etc.).
- (optional) Knowledge about Android apps.

Links

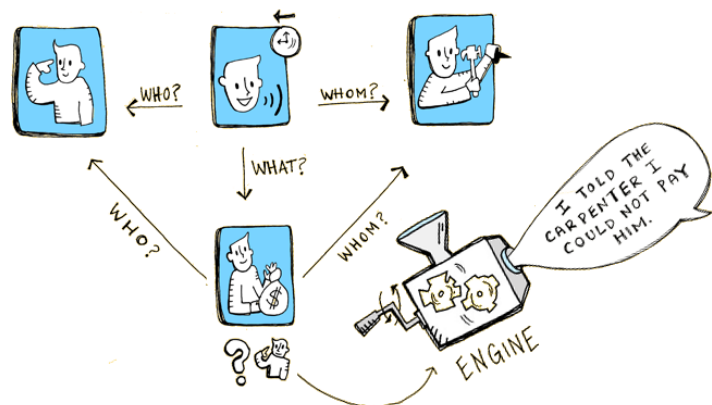
- <https://en.wikipedia.org/wiki/Crowdsourcing>
- <http://www.crowdsourcing.org>
- "Best practices and recommendations for crowdsourced QoE":
http://r.duckduckgo.com/l/?kh=-1&uddg=http%3A%2F%2Fwww3.informatik.uni-wuerzburg.de%2Fstaff%2Fmatthias.hirth%2Fauthor_version%2Fpapers%2Fjour_128_author_version.pdf

Phoneme and language processing in different languages

Goals

- Extract the phonemes from both (1) audio recordings from the crowdsourcing website and from (2) written sentences for potentially any language.
- Enable users to provide a representation of the

meaning of the sentences told by others¹, using predicate-argument form (e.g. bite(dog, ball)) and/or with graphical representation of sentences (e.g. by using maps like "freespeech").



Example of 'freespeech' map.

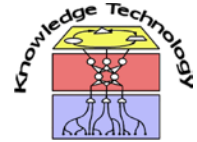
Useful skills

- Interest for sound and language processing.
- (optional) Speaking foreign languages (other than English) is an advantage but not required.

Links

- freespeech: <http://avazapp.com/freespeech/>

¹ This will be used to give the sentence and its meaning to teach the neural language model to be used in the robot.



Remote robot control

Goals

- Enable users to control remotely (from the Internet) a robot simulator and/or a real robot with "raw" commands and some "primitives" (predefines motor commands).
- We want the users to explore and invent many different actions or scene by controlling the robot (that we could not think of).

Useful skills

Links:

<http://robotwebtools.org/tools.html>

<https://github.com/WPI-RAIL/rms>

<http://www.coppeliarobotics.com> (V-REP)

Contact

Dr. Xavier Hinaut, Johannes Twiefel, Erik Strahl, Professor Dr. Stefan Wermter

Email: {hinaut,twiefel,strahl,wermter}@informatik.uni-hamburg.de

