MSE | MASTER OF SCIENCE IN ENGINEERING

Hes·so
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University of Applied Sciences and Arts Western Switzerland

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Master of Science HES-SO in Engineering

Orientation: Information and Communication Technologies (ICT)

GenBot

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Accepted by the HES-SO//Master (Switzerland, Lausanne) on a proposal from:

Prof. Dr. Jean Hennebert, deepening project supervisor
Dr. Christophe Gisler, iCoSys, main expert

Place, date: _____

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Supervisor	Dean, HES-SO//Master

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Acknowledgments

Acknowledgments
if any

Glossary

AdaGrad

Adaptive Gradient Algorithm that maintains a per-parameter learning rate that improves performance on problems with sparse gradients (e.g. natural language and computer vision problems)..

Acronyms

13C

carbon-13.

ACN

Acetonitrile.

CHCA

Cyano 4 hydroxy cinnamic acid.

Abstract

My Abstract

Key words: Data Engineering, Machine Learning, Data Services, Conversational Agents conversational, chatbot, Natural Language Understanding (NLU), generic

Chapter 1

Introduction

Chatbots Beginning of 2019, they are everywhere but very limited to narrow tasks, and are, in most cases, sequences of if-else conditions resulting in a very weak AI. Indeed, hard-coded connections are requiring an infinite amount of human power to create generic Chatbots able to maintain a conversation at a human level. However, the progress in the field of machine learning is demonstrating that providing large corpora to an unsupervised algorithm is enough to maintain a passive conversation with users, which results into a shifting of the human power into data engineering. Multiple algorithms and technics are emerging monthly, which are demonstrating promising conversational performance improvement; however, they are all still narrow AIs. Indeed, even if they are getting better at providing meaningful sentences, they are still not able to generalize all tasks linked to a conversation, such as, understanding the context, search and learn for missing information, initiate conversation in a meaningful manner, be intuitive, and more. The generalization of those features would allow a significant step forward into general Chatbots. Humbly, the goal of this deepening semester project is to suggest and demonstrate approaches as a premise to Artificial General Intelligence and getting a step closer to general Chatbots, which can initiate and maintain human-like conversations in a pro-active manner.

Driver iCoSys, the Institut of Complex Systems at University of Applied Sciences and Arts at Fribourg, Switzerland, is interested into the result of this project as a study for their AI-News project, whose goal is to provide a chatbot as a tool to reader, to help them narrow their interests and deliver the right information. AI-News is in collaboration with Swiss Innovation Agency from the Swiss Confederation, and La Liberté, the daily newspaper from Fribourg.

1.1 Aim of Study

1.2 Scope and Limitation of Study

Chapter 2

Questions

2.1 Initial Broad Questions

- Is the artificial neural network approach appropriate to represent the world?
- Can agents be made exclusively from a language?
- Can agents able to experience an environment?
- Is a narrative environment be enough to understand an environment?
- Is the language able to provide to an agent an understanding of the world?
- Is the knowledge of the language syntax enough to gain an understanding?
- Is the result of unsupervised learning enough to discover all nuances?
- Is the unsupervised learning sufficient to make sense to an environment?
- Is a descriptive explanation of the world be expressed in a language?
- Is the description good enough to catch all the nuances?
- Is the language good enough to explain?
- Can we augment or make a semantic language?
- Can we create a common symbolic language?
- Is the language multi-dimensional?
- How many dimensions are needed for a complex language?
- Is it possible to give a word equivalence to machines for human-specific words?
- Are all emotions describable into words?
- Are emotions altering language descriptions?
- Is an approximation of the real world enough to understand the environment?
- Would a the simulated world be a good approximation of the real world?

2.2 Narrowed Questions

- Common human-machine language
  - Is it possible to create a multi-dimensional human-machine language, which includes a common semantic, symbolic, and emotion definition.
  - Is it possible to create an abstract world for machines to understand human symbolic based on a real world, and define fundamentals for machine representation of the language.
- Machine intuition

  - Is it possible to provide to machines an human-like intuition (inside voice), which would help to keep a long term context and specialize in specific fields.

- Evaluate human-machine communication

  - Is it possible to provide a protocol to test the communication skills and machine understanding.

2.3 Deepening Project Questions

- How to verify and quantify a chatbot understanding?
- What is the premise to make chatbots general with today's technology?
- How chatbot can be proactive?
- How to simulate human-like intuition in chatbots?

Chapter 3

Plan

3.1 Contraints

Timeframe: 15 weeks
Starting date: 18.02.2019
Ending date: 31.05.2019

3.2 Initial Plan

3.2.1 Tasks

1. Initial research about general chatbots
2. Determine the project target
3. Play with the subject
4. Explore the Word2Vec methodology
5. Explore the Word2Vec extensions
6. Combine and test ANN algorithms with Word2Vec
7. Explore ANN algorithm topology for the chatbot
8. Analysis of the chatbot intuition with parallel algorithms
9. Analysis of a protocol to evaluate proactive chatbots
10. Profile-based initiatives
11. Analyze and experiment profile nurturing
12. Analyze and experiment with chatbot initiatives with no profiles
13. Overall improvements
14. Autonomous data gathering
15. Make suggestions
16. Determine possible continuation and future outcomes for the project

3.2.2 Milestones

1. Initial deepening project plan and specification document
2. Basic multi-dimensional word embedding space

3. Basic conversational agent
4. Basic proactive chatbot
5. Deepening project report

3.2.3 Sprints

18.02.19 to 08.03.19 (3 weeks)

- Do the initial research about general chatbots
- Determine the project target
- Play with the subject
- **DELIVERABLE:** Plan and Initial Specification document

11.02.19 to 29.03.19 (3 weeks)

- Explore the Word2Vec methodology and its extensions
- Combine and test ANN algorithms with Word2Vec
- **MVP:** Basic multi-dimensional word embedding space

01.04.19 to 19.04.19 (3 weeks)

- Explore ANN algorithm topology for the chatbot
- Analysis of the chatbot intuition with parallel algorithms
- Analysis of a protocol to evaluate proactive chatbots
- **MVP:** Basic conversational agent

22.04.19 to 10.05.19 (3 weeks)

- Profile-based initiatives
- Analysis and experiment of the profile nurturing
- Analyze and experiment with chatbot initiatives with no profiles.
- **MVP:** Basic proactive chatbot

13.05.19 to 31.05.19 (3 weeks)

- Overall improvements
- Autonomous data gathering
- Make suggestions
- Determine possible continuation and future outcomes for the project
- **DELIVERABLE:** Report + Sources

3.2.4 Gantt chart

3.3 Effective Plan

3.3.1 Tasks

1. Initial research about general chatbots
2. Determine the project target
3. Play with the subject
4. Explore the Word2Vec methodology
5. Explore the Word2Vec extensions

3.3.2 Milestones

1. Initial deepening project plan and specification document
2. Basic multi-dimensional word embedding space

3.3.3 Gantt chart

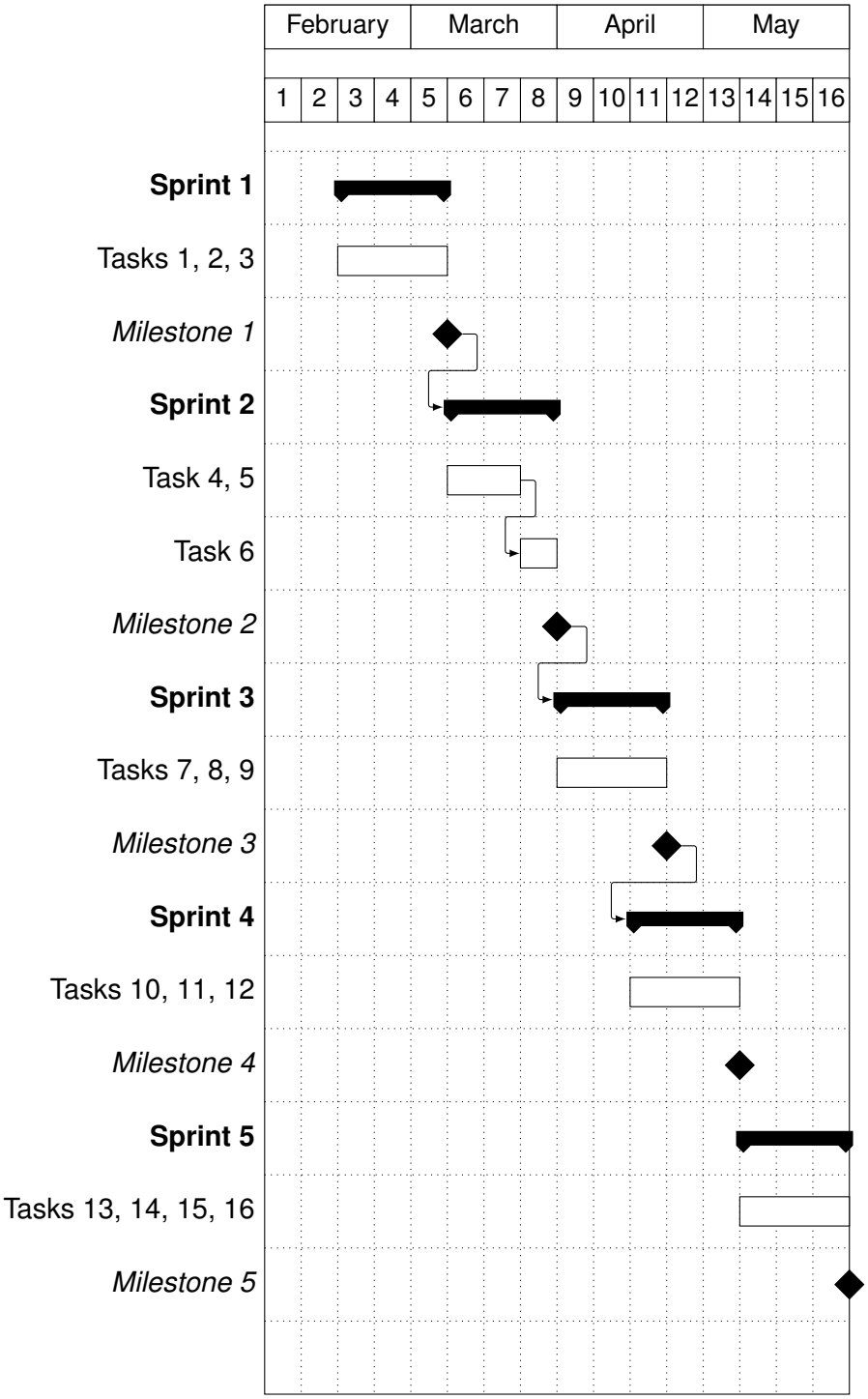

Figure 3.1: Initial Gantt Chart

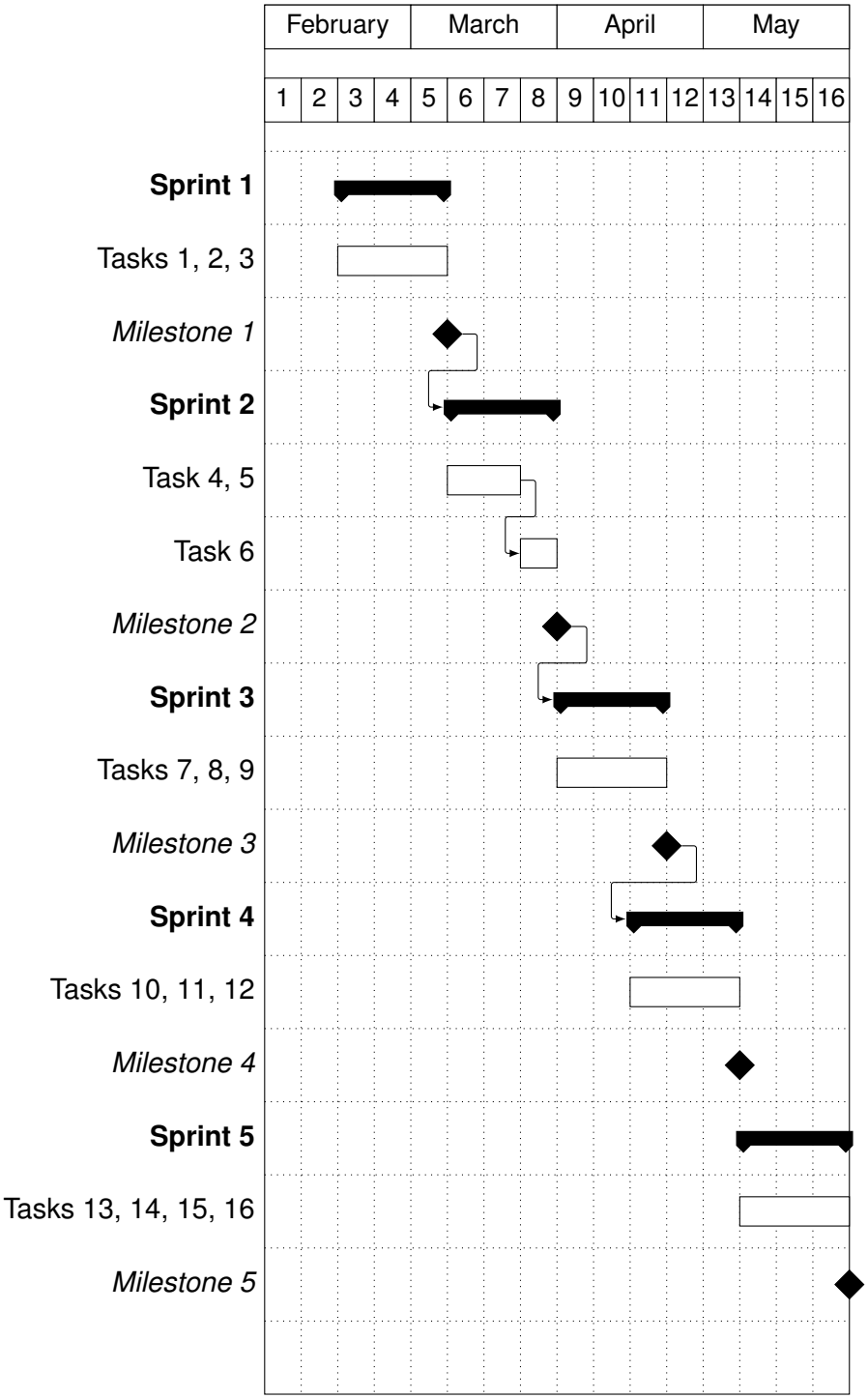

Figure 3.2: Initial Gantt Chart

Chapter 4

Literature Review and Research Proposal

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4.1 State of the art

4.1.1 Patent law

Chapter 5

Results

5.1 Frameworks

5.1.1 Gensim

verify further Memory allocation clai

Errors Memory allocation with multi-core. The problem is occurring during the merge of the cores. Indeed, my current machine has 128GB ram, and the dataset weights about 16GB in the memory, and each core during merging is processing at least the same amount, plus the processed informations.

```
2019-03-25 08:31:18,867 : INFO : PROGRESS: pass 0, dispatched chunk #34 = documents up to #70000/4614519, outstanding queue
 size 31
Exception in thread Thread-1:
Traceback (most recent call last):
  File "/usr/lib/python3.5/threading.py", line 914, in _bootstrap_inner
    self.run()
  File "/usr/lib/python3.5/threading.py", line 862, in run
    self._target(*self._args, **self._kwargs)
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 366, in _handle_workers
    pool._maintain_pool()
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 240, in _maintain_pool
    self._repopulate_pool()
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 233, in _repopulate_pool
    w.start()
  File "/usr/lib/python3.5/multiprocessing/process.py", line 105, in start
    self._popen = self._Popen(self)
  File "/usr/lib/python3.5/multiprocessing/context.py", line 267, in _Popen
    return Popen(process_obj)
  File "/usr/lib/python3.5/multiprocessing/popen_fork.py", line 20, in __init__
    self._launch(process_obj)
  File "/usr/lib/python3.5/multiprocessing/popen_fork.py", line 67, in _launch
    self.pid = os.fork()
OSError: [Errno 12] Cannot allocate memory
```

Figure 5.1: Error 1

5.2 Materials

5.3 Products

```
2019-03-25 08:31:18,867 : INFO : PROGRESS: pass 0, dispatched chunk #34 = documents up to #70000/4614519, outstanding queue
 size 31
Exception in thread Thread-1:
Traceback (most recent call last):
  File "/usr/lib/python3.5/threading.py", line 914, in _bootstrap_inner
    self.run()
  File "/usr/lib/python3.5/threading.py", line 862, in run
    self._target(*self._args, **self._kwargs)
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 366, in _handle_workers
    pool._maintain_pool()
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 240, in _maintain_pool
    self._repopulate_pool()
  File "/usr/lib/python3.5/multiprocessing/pool.py", line 233, in _repopulate_pool
    w.start()
  File "/usr/lib/python3.5/multiprocessing/process.py", line 105, in start
    self._popen = self._Popen(self)
  File "/usr/lib/python3.5/multiprocessing/context.py", line 267, in _Popen
    return Popen(process_obj)
  File "/usr/lib/python3.5/multiprocessing/popen_fork.py", line 20, in __init__
    self._launch(process_obj)
  File "/usr/lib/python3.5/multiprocessing/popen_fork.py", line 67, in _launch
    self.pid = os.fork()
OSError: [Errno 12] Cannot allocate memory
```

Figure 5.2: Error 2

Chapter 6

Discussion

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Chapter 7

Experimental Part

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Chapter 8

Conclusion

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AdaGrad Acetonitrile (ACN) 13C Cyano 4 hydroxy cinnamic acid (CHCA)

Lausanne, April 29, 2019

Romain Claret

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Appendix

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.0.1 Appendix

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