An Introduction To Machine Learning Sorcery

(Part 1: Fuzzy Logic & Neural Networks)[a]

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[a]Available @ https://github.com/a-mhamdi/isetbz/

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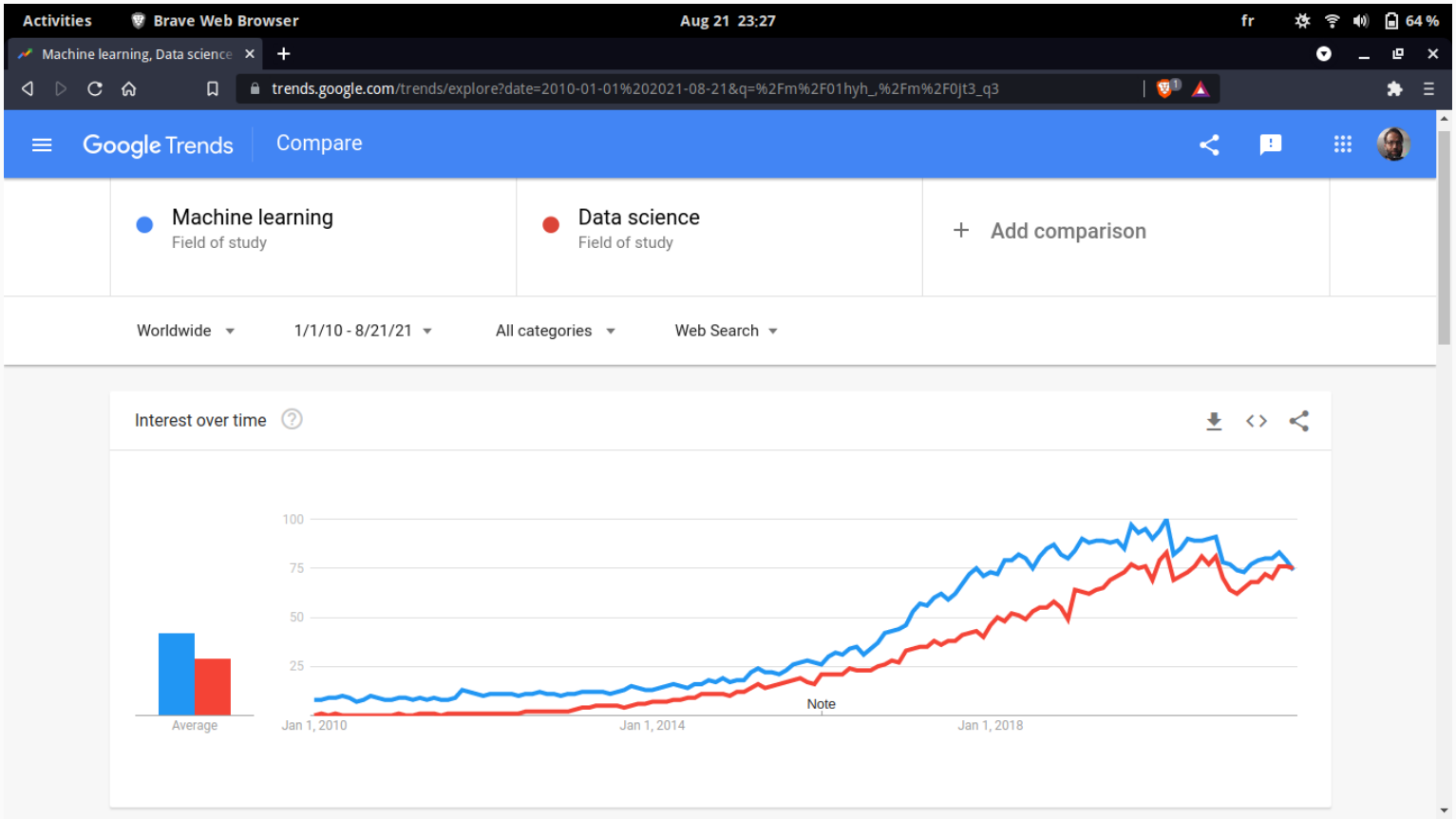
Roadmap

1. An overview
2. Fuzzy Logic
3. Neural Networks

An overview

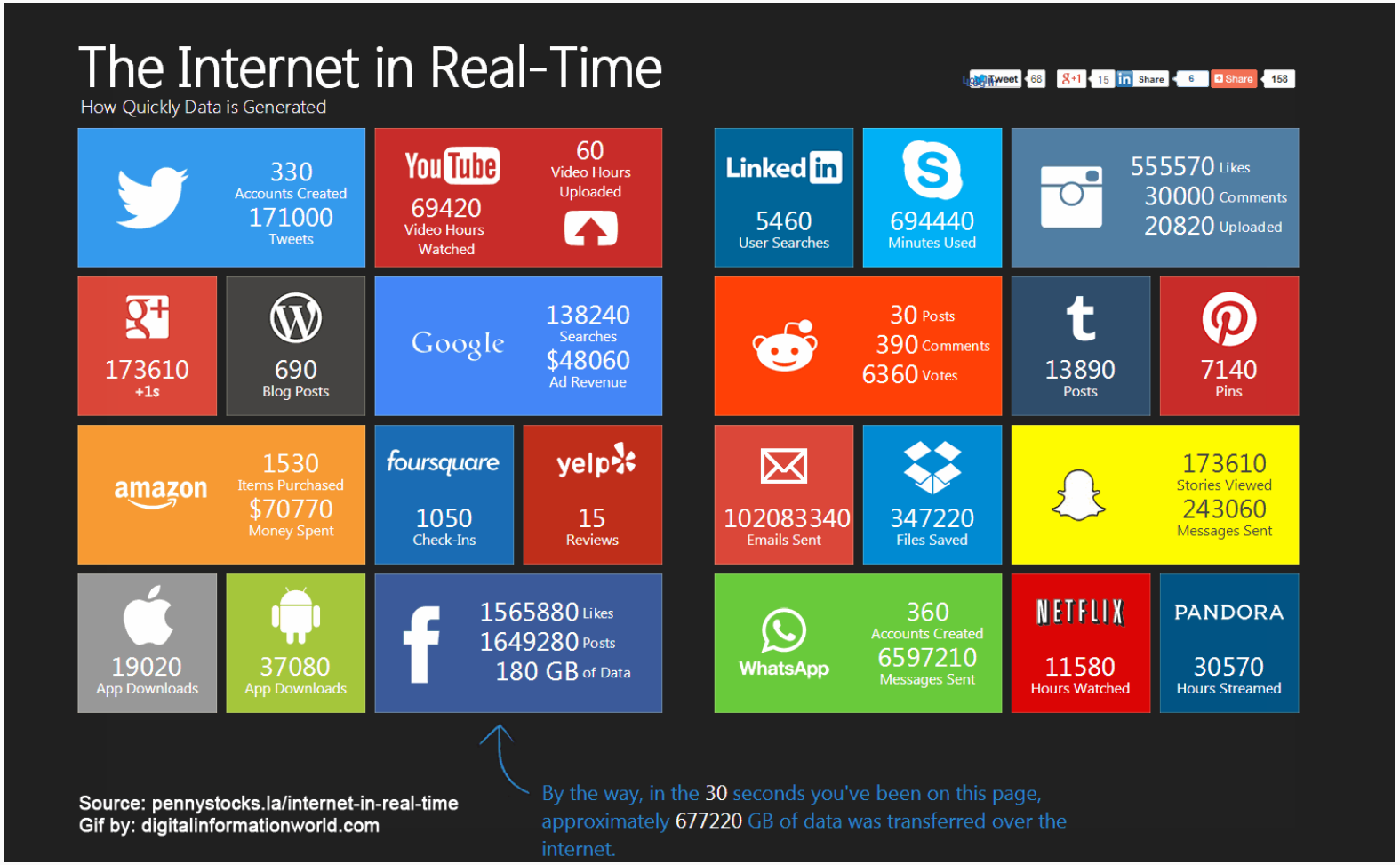
Trends



"Numbers represent search interest relative to the highest point on the chart for the given region and time.

- A value of 100 is the peak popularity for the term;
- A value of 50 means that the term is half as popular;
- A score of 0 means there was not enough data for this term."

Global Data Traffic



Update on the internet in real time is available here.

Top Uses


YouTube


Gboard


Google
Translate


amazon


Hi, how can I help?


amazon
alexa


Hi, I'm Cortana.

Literature Review (1/3)

[Mit97]

> "The field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience."

Mitchell, T. (1997) *Machine Learning*. **McGraw-Hill International Editions. McGraw-Hill.**

Literature Review (2/3)

[Woj12]

"Machine learning (ML) is a scientific discipline that concerns developing learning capabilities in computer systems. Machine learning is one of central areas of Artificial Intelligence (AI). It is an interdisciplinary area that combines results from statistics, logic, robotics, computer science, computational intelligence, pattern recognition, data mining, cognitive science, and more."

Wojtusiak, J. (2012) Machine learning. **In *Encyclopedia of the Sciences of Learning*, pages 2082–2083. Springer US.**

Literature Review (3/3)

[ENM15]

"Machine learning is an evolving branch of computational algorithms that are designed to emulate human intelligence by learning from the surrounding environment. They are considered the working horse in the new era of the so-called big data. Techniques based on machine learning have been applied successfully in diverse fields ranging from pattern recognition, computer vision, spacecraft engineering, finance, entertainment, and computational biology to biomedical and medical applications. [...] The ability of machine learning algorithms to learn from current context and generalize into unseen tasks would allow improvements in both the safety and efficacy of radiotherapy practice leading to better outcomes."

El Naqa, I. and Murphy, M. J. (2015) *What Is Machine Learning?*, pages 3–11. **Springer International Publishing.**

Machine Learning is a branch of computer science, focuses on automation of intelligent behavior.

Some definitions can be categorized into four frames.

Systems that think like humans

[Bel78]

> "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning..."

Bellman, R. E. *An Introduction to Artificial Intelligence: Can Computers Think?* **Boyd & Fraser Publishing Company.**

[Hau89]

> "The exciting new effort to make computers think[...] *machines with minds*, in the full and literal sense"

Haugeland, J. (1989). *Artificial Intelligence: The Very Idea*. **A Bradford book. MIT Press.**

Systems that think rationally

[CMM85]

"The study of mental faculties through the use of computational models."

Charniak, E., McDermott, D., and McDermott, D. V. (1985). *Introduction to Artificial Intelligence*. **Addison-Wesley series in computer science and information processing. Addison-Wesley.**

[Win92]

"The study of the computations that make it possible to perceive, reason, and act."

Winston, P. H. (1992). *Artificial Intelligence*. **A-W Series in Computer Science. Addison-Wesley Publishing Company.**

Systems that act like humans

[Kur92]

> "The art of creating machines that perform functions that require intelligence when performed by people."

Kurzweil, R. (1992). *The Age of Intelligent Machines*. **Viking.**

[RK91]

> "The study of how to make computers do things at which, at the moment, people are better."

Rich, E. and Knight, K. (1991). *Artificial Intelligence*. **Artificial Intelligence Series. McGraw-Hill.**

Systems that act rationally

[Sch90]

"A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes."

Schalkoff, R. J. (1990). *Artificial Intelligence: An Engineering Approach*. **McGraw-Hill Computer science series. McGraw-Hill.**

[LS93]

"The branch of computer science that is concerned with the automation of intelligent behavior."

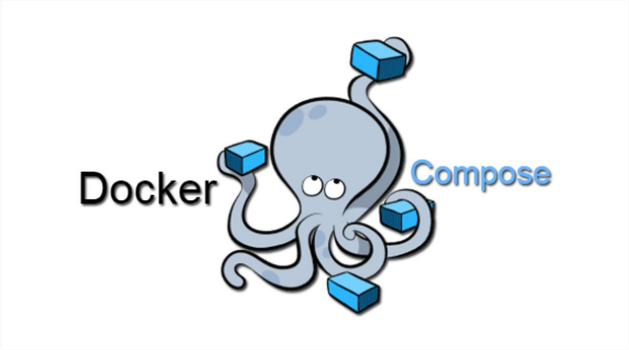
Luger, G. F. and Stubblefield, W. A. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. **Artificial intelligence. Benjamin/Cummings Publishing Company.**

Programming Language

julialang.org/

Development Environments

Pluto.jl

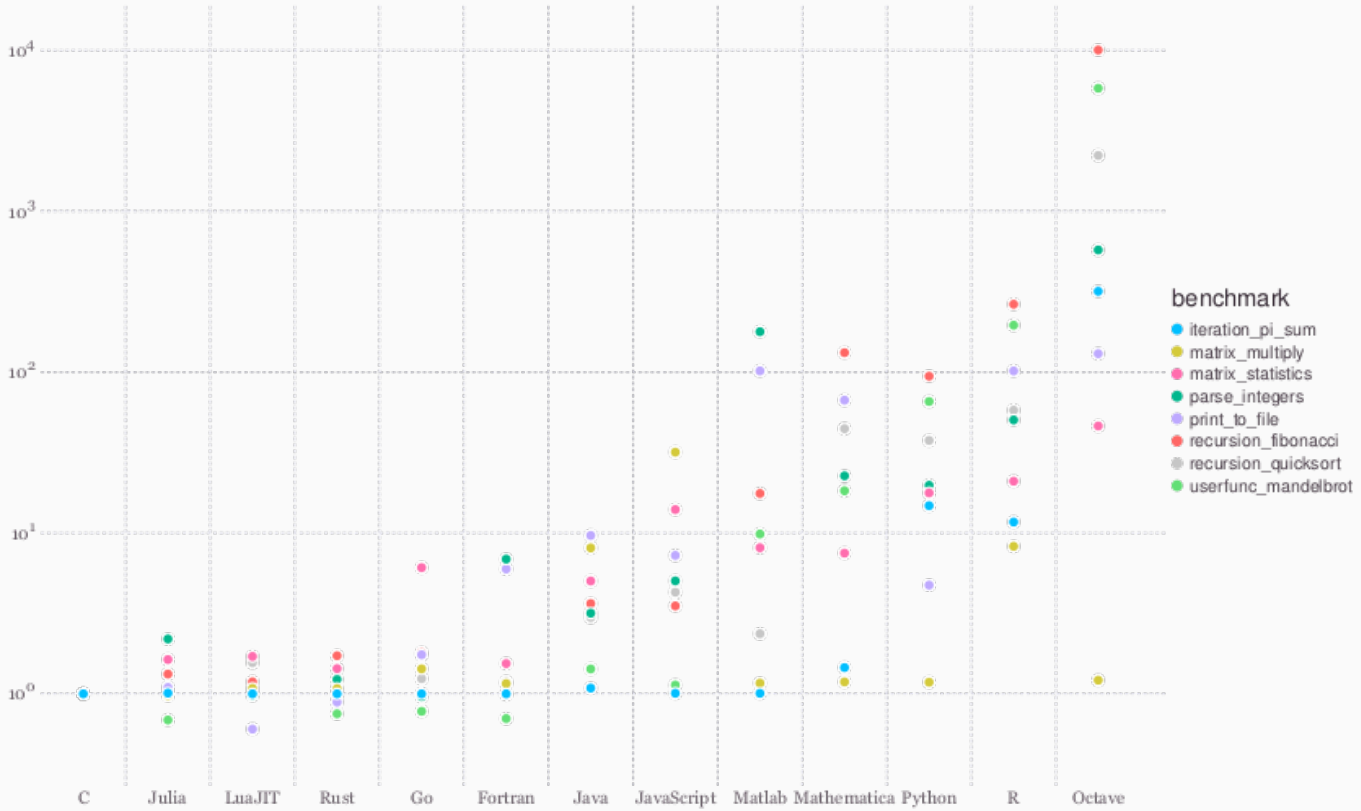


- ▲ $ docker compose up
- ▼ $ docker compose down

Julia in a Nutshell

- Fast
- Dynamic
- Reproducible
- Composable
- General
- Open Source

Julia Micro-Benchmarks (1/2)



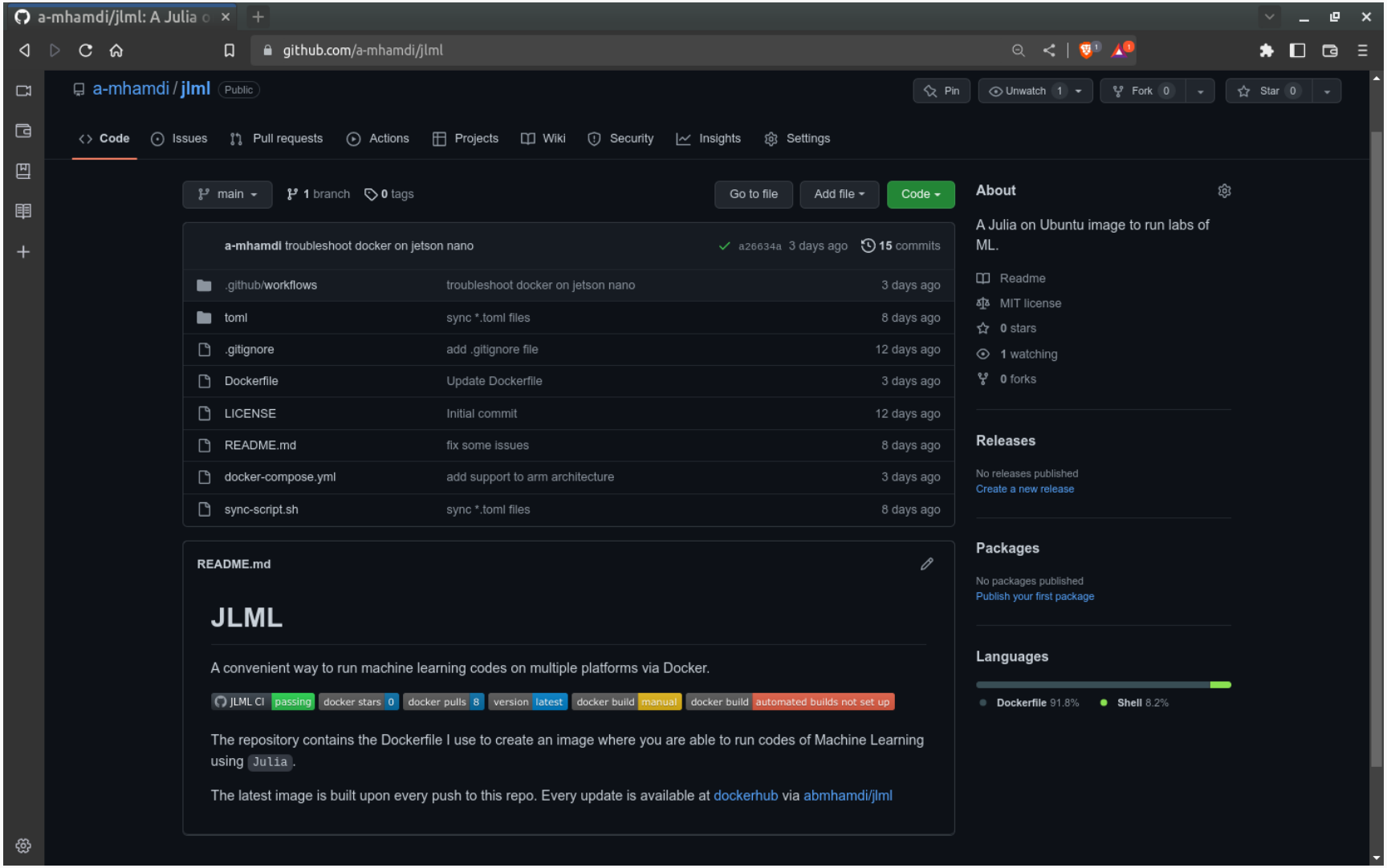
https://julialang.org/benchmarks

Julia Micro-Benchmarks (2/2)

Geometric Means of Micro-Benchmarks by Language

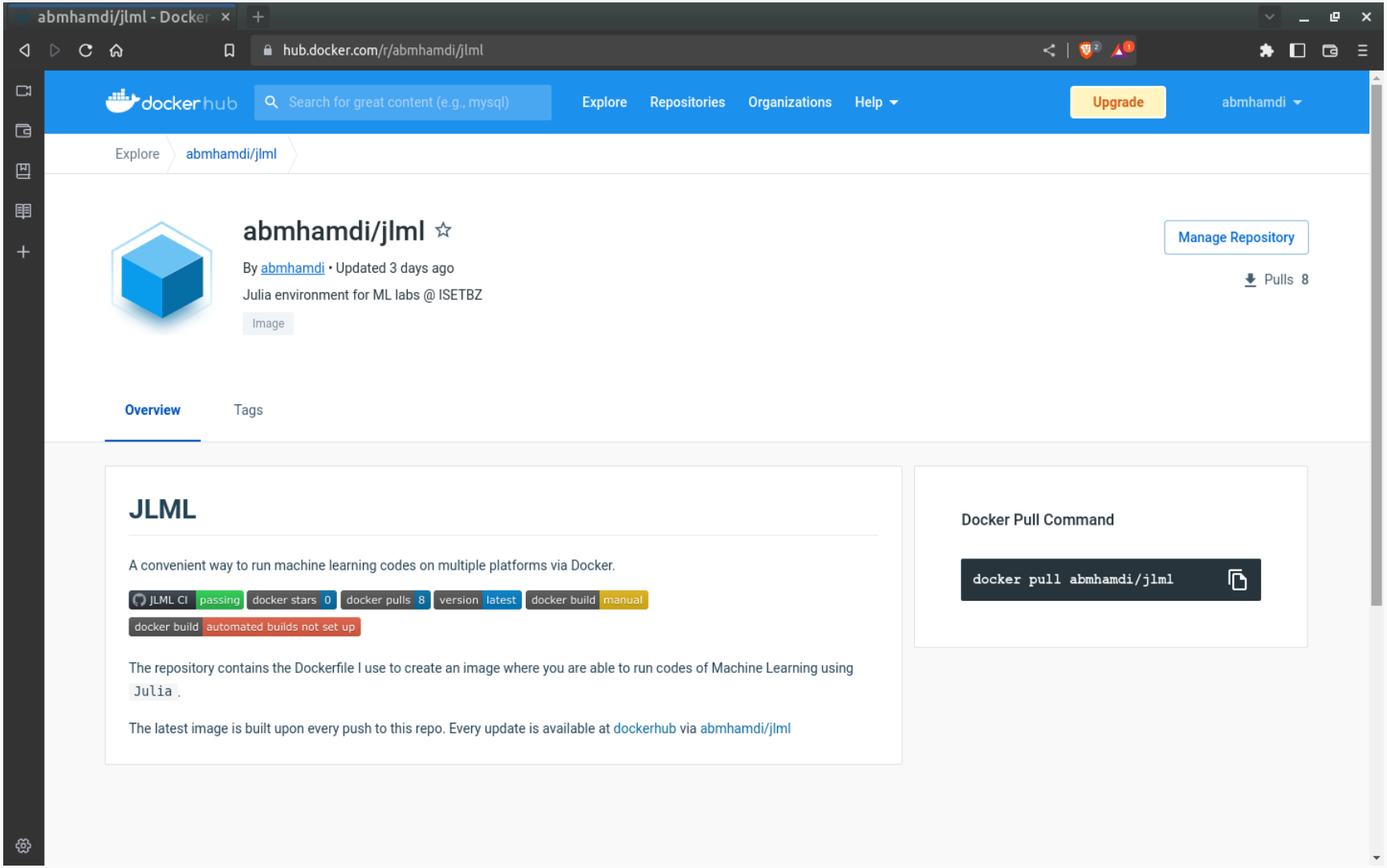
1	C	1.0
2	Julia	1.17006
3	LuaJIT	1.02931
4	Rust	1.0999
5	Go	1.49917
6	Fortran	1.67022
7	Java	3.46773
8	JavaScript	4.79602
9	Matlab	9.57235
10	Mathematica	14.6387
11	Python	16.9262
12	R	48.5796
13	Octave	338.704

Source Control Management (SCM)



https://github.com/a-mhamdi/jlml

Continuous Integration (CI)



https://hub.docker.com/r/abmhamdi/jlml

Fuzzy Logic

Neural Networks

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[JPM21] L. M. John Paul Mueller. *Machine Learning For Dummies*. Wiley John + Sons, Apr. 8, 2021. 464 pp.

[Kur92] R. Kurzweil. *The Age of Intelligent Machines*. Viking, 1992 (cit. on p. 14).

[LS93] G. F. Luger and W. A. Stubblefield. *Artificial Intelligence: Structures and Strategies for*