An insight into HOL-Isabelle/Coq Theorem Provers based Design of Advanced Novel Algorithms Using [Minsky Machines [MM] + Scala NLP/Scala/Akka/JikesRVM - Research Virtual Machine/ JVM/LLVM & Poly/ML] in the Context of Electronic Health Record [EHR] Software R&D - A Simple Suggestion on Using : :-> { Clam AV + nGraph + NLP + Smart Devices [SD] + IoT/AoT Compilers + HPC - High Performance Computing Systems }.

*[Exploring Challenges involving : HOL/Coq + Minsky Machines Theory + nGraph + NLP Theory → Hi-Fi Health Care Information Systems Monitoring with "**Antivirus** on a **Raspberry Pi** using **ClamAV**"]*

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Abstract :

Understanding+Probing Higher Order Logic (HOL-Isabelle)/Coq System based Minsky Machines and Implementing [Scala/Scala-NLP/Scala LAB] in the context of EHR Informatics R&D Framework – We are presenting here a Novel Approach in Designing Healthcare Informatics for [Raspberry PI Computer/Scala-IoT/HPC/Java/JikesRVM- Research Virtual Machine/PolyML/nGraph/Clam AV/JVM-Java Virtual Machine/MetascalaVM (Scala Virtual Machine)/AKKA-Scala/Java Framework] Heterogeneous Environments.To the best of our knowledge,this short communication or technical notes is one of the important pioneering research efforts in Electronic Health Record Software (EHR Software) Development.

keywords : HOL-Isabelle/Coq/Minsky Machines/NLP/ScalaNLP/EHR Software/JikesRVM/JVM/Scala VM/IoT/HPC.

[I] Inspiration + Introduction :

An Inspiration & Suggestion to Probe "Minsky Machines" in the Context of DNA based Informatics towards better Anticipation of "Developmental Biology". - by Nirmal Tej Kumar (((((via))))) Vixra.org .

Implementation of Python based EHR/EMR Software Prototyping Informatics Framework – A Novel & Simple Algorithm Using spaCy+Theorem Prover+Data Bases+QRNG Concepts+Deep Learning Methods by Nirmal Tej Kumar – (((((via))))) http://www.vixra.org/pdf/1909.0407v1.pdf

Exploring Ruby Based Bio-informatics R&D Framework Using NLP/BioNLP/SVM/QRNG/HPC/IoT/Mongo DB/BaseX DB Systems & Related Environments – A Novel Multidisciplinary Approach - by Nirmal Tej Kumar (((((via))))) Vixra.org

[spaCy+ImageAI+Spin Glass Theory+Z3 API] all in Python Language – An Insight into the World of Natural Language Processing(NLP) towards Understanding Informatics of Finite Automata involving DNA Sequencing & Some Interesting Applications like Gene Chips. [Exploring – NLP+Spin Glass Theory+AI+Theorem Proving in the Context of Developing Next Generation Bio-informatics] - by Nirmal Tej Kumar (((((via))))) Vixra.org

[Source for all Vixra.org Communications : http://www.vixra.org/author/nirmal_tej_kumar]

From Artificial Neural Networks to Emotion Machines with Marvin Minsky –
https://uni-obuda.hu/journal/Kelemen_12.pdf

www.igblan.free-online.co.uk/igblan/ca/minsky.html

https://www.researchgate.net/publication/275669934_Minsky_Machines_and_Algorithmic_Problems

http://web.media.mit.edu/~minsky/ - Marvin Minsky has made many contributions to AI, cognitive psychology, mathematics, computational linguistics, robotics, and optics. For more information,please visit the Website. https://www.britannica.com/biography/Marvin-Lee-Minsky

https://www.the-scientist.com/foundations/machine--learning--1951-65792 - Machine, Learning, 1951-Marvin Minsky engineered the first known artificial neural network.

Isabelle/HOL and Coq are currently the world's two leading proof assistants. Hence,it is useful to solve some mathematical problems using these two tools to advance Software R&D.

Raspberry PI − Computing Aspects & Scala based IoT Applications : "Let's start our journey for making the first IoT application.In this blog finally the two technologies SCALA and IoT will meet and we will be doing these many things in this blog" - [https://codequs.com/p/Byo88Mnoo/iot-application-using-scala-on-raspberrypi/]

[a] https://blog.knoldus.com/scala-iot-getting-started-with-raspberrypi-without-monitor-or.
[b] https://dzone.com/articles/scala-iot-first-basic-iot-application-using-scala-2
[c] https://data-flair.training/blogs/iot-raspberry-pi

[d] https://iotdesignpro.com/projects/getting-started-with-eclipse-ide-using-raspberry-pi
[e] https://www.elprocus.com/building-the-internet-of-things-using-raspberry-pi
[f] https://iotdesignpro.com/projects/getting-started-with-eclipse-ide-using-raspberry-pi
[g] https://pavelfatin.com/install-scala-on-raspberry-pi

Raspberry Pi Foundation − Raspberry Pi Computer Website Information :

[a] https://www.raspberrypi.org/ +
[b] https://raspberrypi.workable.com/ +
[c] https://www.raspberrypi.org/downloads/ +
[d] https://www.raspberrypi.org/downloads/raspbian/ - Raspbian is the Foundation's official supported operating system.
Raspbian comes pre-installed with plenty of software for education, programming and general use.
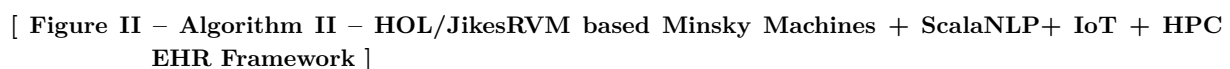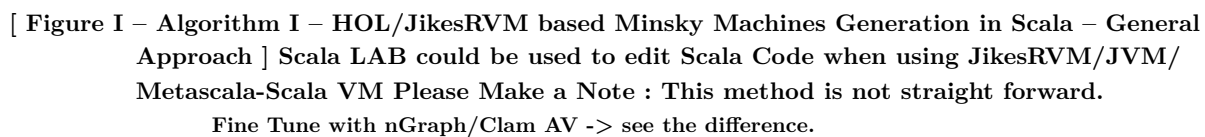It has Python,Scratch,Sonic Pi,Java and more.
[e] https://pimylifeup.com/raspberry-pi-clamav/

Important Remark : Just fine tune the algorithms below with nGraph ; https://www.intel.com/content/www/us/en/artificial-intelligence/ngraph.html#
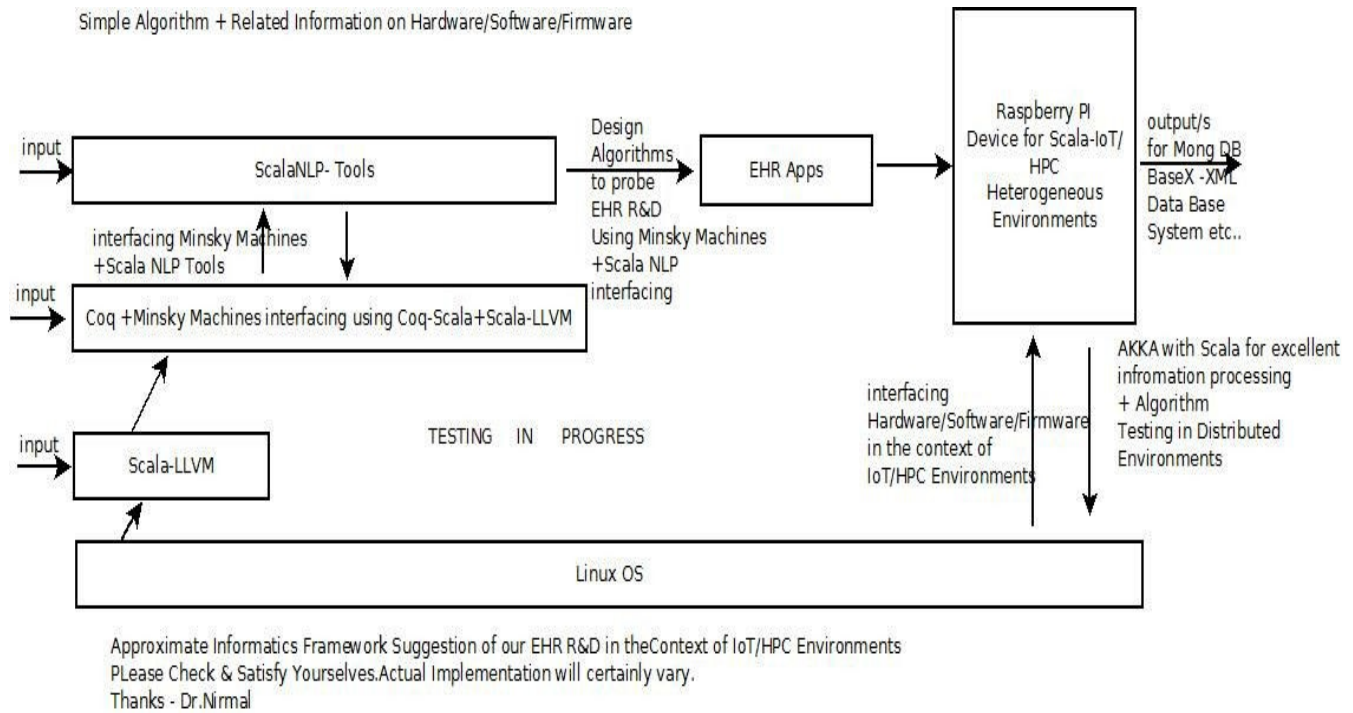
"Focus on Data Science, not on Machine Code ->

While a compiler may seem like a basic component of software workflow, its importance is amplified when considering the multiarchitecture hardware environment coupled with an increasing number of deep learning frameworks. The technical benefits of a compiler—efficient memory management, data layout abstraction, training vs. inference optimizations, multinode and multidevice scaling, and hardware-specific compounding of operations—help ensure you get the benefits of cross-platform flexibility without a loss in performance."

[II] Algorithms Probing EHR With Scala NLP + Minsky Machines + HOL-Isabelle + Coq Theorem Prover :

General Understanding of Minsky Machines based Higher Order Logic-Isabelle Platform & JikesRVM - Research Virtual Machine
Simple Algorithm To Test Minsky Machines by generating Scala Code - HOL/Isabelle System

generate Minsky Machines in Scala & examine Scala Code for better understanding
to develop Algorithms to probe EHR Applications.

Examine HOL-Isabelle System Library for researching Minsky Machines

JikesRVM - Research Virtual Machine

Approximate Suggestion Only.Actual Implementation might vary to some extent.
Please Check & Satisfy Yourselves.
Thanks - Dr.Nirmal
See our publications on Vixra.org

[Figure I – Algorithm I – HOL/JikesRVM based Minsky Machines Generation in Scala – General
Approach] Scala LAB could be used to edit Scala Code when using JikesRVM/JVM/
Metascala-Scala VM Please Make a Note : This method is not straight forward.
Fine Tune with nGraph/Clam AV -> see the difference.

Simple Algorithm + Related Information on Hardware/Software/Firmware

Approximate Informatics Framework Suggestion of our EHR R&D in theContext of IoT/HPC Environments
PLease Check & Satisfy Yourselves.Actual Implementation will certainly vary.
Thanks - Dr.Nirmal

[Figure II – Algorithm II – HOL/JikesRVM based Minsky Machines + ScalaNLP+ IoT + HPC
EHR Framework]

Scala LAB could be used to edit Scala Code when using JikesRVM/JVM/Metascala-Scala VM
Please Make a Note : This method is not straight forward.
Fine Tune with nGraph/Clam AV.

Simple Algorithm + Related Information on Hardware/Software/Firmware

[**Figure III – Algorithm III – Coq/Scala-Coq/Scala-LLVM based Minsky Machines + Scala NLP + nGraph/Clam AV + Smart Devices + IoT + HPC EHR Framework**]

Please Make a Note : This method is not straight forward.

Some Points/Notes on Electronic Health Record - EHR :

An electronic health record (EHR) is the systematized collection of patient and population electronically-stored health information in a digital format.These records can be shared across different health care settings. Records are shared through network-connected, enterprise-wide information systems or other information networks and exchanges. EHRs may include a range of data, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal statistics like age and weight, and billing information [**Source – Wiki**]

[a] https://www.techradar.com/best/best-electronic-health-record-ehr-software

[b] https://www.healthit.gov/faq/what-electronic-health-record-ehr

[c] https://en.wikipedia.org/wiki/Electronic_health_records_in_the_United_States

[d] https://health.usf.edu/is/blog/2018/02/13/The HITECH Act and Electronic Health Records

[e] https://medium.com/crypt-bytes-tech/medicalchain-a-blockchain-for-electronic-health..

[III] Related R&D Information in the Context of Mathematics + Software Used :

[a] https://github.com/paholg/minsky

[b] https://www.isa-afp.org/entries/Minsky_Machines.html – HOL - Isabelle System based Minsky Machines.

[c] ttps://esolangs.org/wiki/Portable_Minsky_Machine_Notation

[d] https://isabelle.in.tum.de/ - **Very much interesting & challenging to use -** HOL - Isabelle Platform

[e] https://github.com/NextTechLab/Minsky-AI-Roadmap

[f] https://github.com/Wheatwizard/MinskyMachineToBrain-Flak

[g] ml.informatik.uni-freiburg.de/former/_media/documents/teaching/ss09/ml/... · PDF file

[h] **https://isabelle.in.tum.de/doc/codegen.pdf** – Code Generation Using HOL System in SML/Haskell/Ocaml/Scala **-**"This tutorial introduces the code generator facilities of Isabelle/HOL.They empower the user to **turn HOL specifications into corresponding executable programs** in the languages - **SML,OCaml, Haskell and Scala**."

[i] **https://coq.inria.fr/** **-** Coq is a formal proof management system. It provides a formal language to write mathematical definitions, executable algorithms and theorems together with an environment for semi-interactive development of machine-checked proofs.

[j] **https://cedric.cnam.fr/fichiers/art_4027.pdf** **-** A Coq-based synthesis of Scala programs which are correct-by-construction.

[k] **https://greedy.github.io/scala-llvm/scalallvm.pdf** **-** Compiling Scala to LLVM.

[l] https://scala-lms.github.io/ - Program Generation and Embedded Compilers in Scala. Lightweight Modular Staging (LMS) is a runtime code generation approach. The framework provides a library of core components for building high performance code generators and embedded compilers in Scala.

LMS is used by several other projects, including :

Delite : domain-specific languages for heterogeneous parallel computing.
Spiral : library generators for high-performance numerical kernels.
LegoBase : query compilation in database systems.

[m] https://**akka**.io - Build powerful reactive, concurrent, and distributed applications more easily. **Akka** is a toolkit for building highly concurrent, distributed, and resilient message-driven applications for Java and Scala.Akka is a free and open-source toolkit and runtime simplifying the construction of concurrent and distributed applications on the JVM. Akka supports multiple programming models for concurrency, but it emphasizes actor-based concurrency, with inspiration drawn from Erlang.

[n] https://**scala**-lang.org – Scala is a general-purpose programming language providing support for functional programming and a strong static type system. Designed to be concise, many of Scala's design decisions aimed to address criticisms of Java.

[o] LLVM - The LLVM Project is a collection of modular and reusable compiler and toolchain technologies.Despite its name, LLVM has little to do with traditional virtual machines. The name "LLVM" itself is not an acronym; it is the full name of the project [http://llvm.org/]

[p] JikesRVM - JikesRVM (Research Virtual Machine) provides a flexible open **'testbed'** to prototype virtual machine technologies and experiment with a large variety of design alternatives. The system is licensed under an OSI approved license. JikesRVM runs on many platforms and advances the state-of-the-art of virtual machine technologies for dynamic compilation, adaptive optimization, garbage collection, thread scheduling, and synchronization . [https://www.jikesrvm.org/]

[q] nGraph : nGraph Library is an open-source C++ library and run-time / compiler suite for Deep Learning ecosystems. With nGraph Library,data scientists can use their preferred deep learning framework in S&T Domains.

[IV] Conclusion/s With Focus on Future Challenges & Perspectives :

I do not regard this technical notes as finished. More investigations are underway to develop Novel Algorithms to advance Scala NLP/nGraph/Clam AV/Minsky Machines based EHR Software/Health Care Informatics R&D.

[*With Thanks from Nirmal*]

Point Worth Noting - "There are three basic approaches to AI: Case-based, rule-based, and connectionist reasoning." Marvin Minsky

[V] Acknowledgment/s :

Special Thanks to all WHO made this happen in my LIFE. Non-profit R&D.Inspire others always.

[VI] Reference/s :

Please check our information.

[VII] Important Additional Information on Keywords Used :

Isabelle/HOL – Higher Order System – Using Isabelle Theorem Prover.

Coq – Theorem Prover.

Minsky Machines – A **Minsky machine** is a finite-state automaton with access to a number of unbounded registers or counters.Minsky machines with two or more registers have been shown to be in the same computational class as Turing machines .

NLP & Scala/ScalaNLP – Natural Language Processing & Scala based Natural Language Processing Tools.

EHR Software – Electronic Health Record Software.

JikesRVM/JVM – Jikes Research Virtual Machine as Java Virtual Machine in our R&D effort. Any other JVM could be used as well.

Metascala/Scala VM – Scala based JVM – it needs a Java Virtual Machine to RUN.

IoT – Internet of Things.

HPC – High Performance Computing.

ScalaLab- ScalaLab: Efficient MATLAB like scientific computing for the Java platform with Scala 2.12, for Scala 2.13.

Akka - Akka is a toolkit for building highly concurrent, distributed, and resilient message-driven applications for Java and Scala on the JVM/JikesRVM-JVM Environments.

Raspberry Pi for Scala + IoT + HPC Environments – The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation. [*It is about Raspberry Pi Computer*].

"https://timesofindia.indiatimes.com/india/after-cyberattack-on-aiims-icmr-website-faces-6000-hacking-attempts/articleshow/96031036.cms"

We are suggesting some simple algorithms using the above idea in the context of Cyber Attacks.

[**THE END**]