

**An Interesting Novel Insight into the [Ocaml+Theorem Prover+AI/ML+Java+Prolog+BaseX-XML DB/
Mongo DB Systems+Imaging Mathematics-Linear Algebra] to Probe Radiation Oncology Informatics
+BIG DATA.**

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Abstract :

[Ocaml+AI/ML-Owl+Coq Theorem Prover+q*cert-query compiler system+Java/JikesRVM-Research Virtual Machine/JVM-Java Virtual Machine/JIProlog+BaseX-XML Data Base System/Mongo DB] DICOM based Medical Image Processing Platform for Radiation Oncology Informatics R&D .Ocaml facilitates industry programmers & Academic researchers to develop robust analytical applications using functional language at a large scale. Hence,our Short Communication & Simple Technical Notes is presented with pleasure.To the best of our knowledge, this is one of the pioneering R&D efforts in this challenging domain.

Keywords – Ocaml/Prolog/JikesRVM/Coq/Owl/DICOM/BaseX/MongoDB/Medical Images/BIG DATA/Radiation Oncology Informatics/Linear Algebra.

[I] Inspiration +Introduction :

CAML - Categorical Abstract Machine Language - “OCaml is the main implementation of the Caml programming language created in 1996 by Xavier Leroy, Jérôme Vouillon, Damien Doligez, Didier Rémy, Ascánder Suárez, and others. It extends Caml with object-oriented features, and is a member of the ML family “

“The Ocaml [toolchain](#) includes an interactive top-level [interpreter](#), a [bytecode compiler](#), an optimizing [native code](#) compiler, a reversible [debugger](#), and a package manager (OPAM). It has a large [standard library](#), which makes it useful for many of the same applications as [Python](#) and [Perl](#), and has robust modular and object-oriented programming constructs that make it applicable for large-scale [software engineering](#)” . [Source – Wiki]

Java is a high-level programming language originally developed by Sun Microsystems and released in 1995. Java runs on a variety of platforms, such as Windows, Mac OS, and the various versions of UNIX. [Source : Wiki]

Jikes Research Virtual Machine-RVM is a mature virtual machine that runs programs written for the Java platform. Unlike most other Java virtual machines, it is written in the programming language Java, in a style of implementation termed meta-circular. [Source : Wiki]

Owl is an OCaml library for scientific computing and machine learning using functional programming. Owl is an OCaml library for scientific computing. It enables academic researchers to fast prototype machine learning algorithms and construct deep neural networks with very concise code. It also facilitates industry programmers to develop robust analytical applications using functional language at a large scale – [Artificial Intelligence](#) .

<http://vixra.org/pdf/1905.0186v1.pdf> – [Towards AI/ML/DL based Interfacing of Engineering/Physics/Biology/Medicine Domain Platforms]

Mongo DB – [MongoDB is a cross-platform document-oriented database program. Classified as a NoSQL database program](#)

BaseX – XML based Robust Data Base System – See the details mentioned as a reference.

Jl Prolog – “A Prolog interpreter, pure Java 100%, cross-platform and Open Source – JIProlog enhances the Java platform by adding the power of Prolog language and extends Prolog by adding the Java framework – JIProlog integrates Prolog and Java languages in a very fascinating way. It allows calling Prolog predicates from Java without dealing with native code (JNI)”. [Source – <http://www.jiprolog.com/>]

DICOM – Digital Imaging and Communications in Medicine (DICOM) is the standard for the communication and management of medical imaging information and related data.
[Source – Wiki] && [Source – <https://www.dicomstandard.org>]

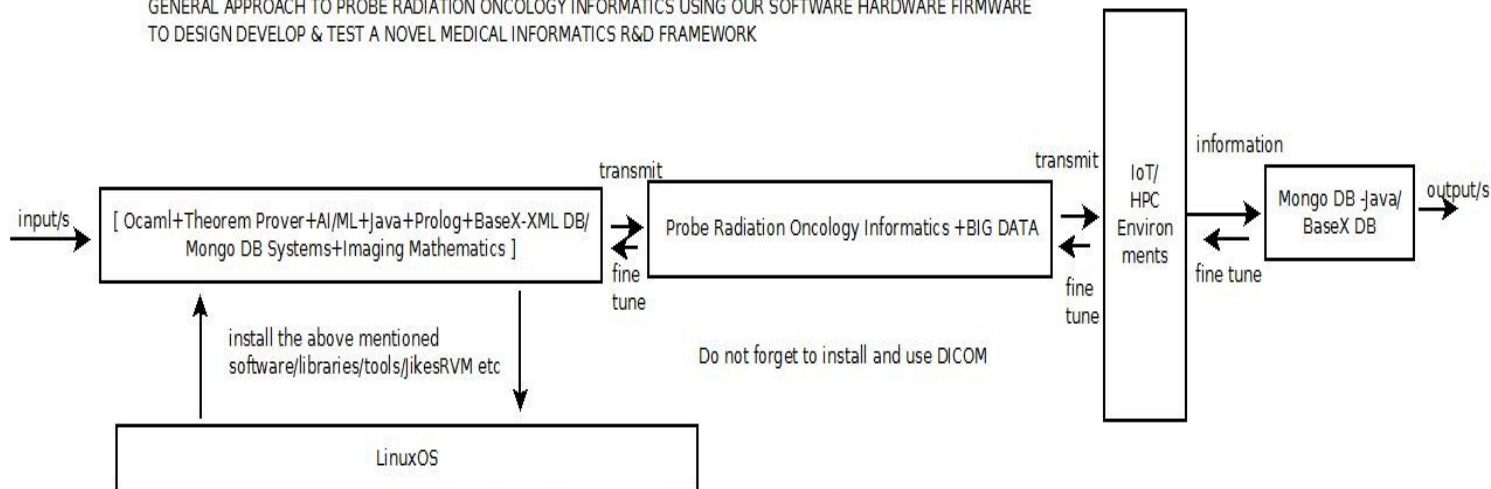
Radiation Oncology Informatics – **Radiation oncology informatics** includes **informatics** from the perspectives of every discipline involved in **radiation oncology**. [Source – https://link.springer.com/chapter/10.1007/978-3-319-18305-3_5]

Radiation Oncology – A **radiation oncologist** is a specialist physician who uses ionizing **radiation** (such as megavoltage X-rays or [radionuclides](#)) in the treatment of cancer. **Radiation oncology** is one of the three primary specialties, the other two being surgical and medical **oncology**, involved in the treatment of cancer.
[Source – Wiki] && [Source – <https://www.targetingcancer.com.au/about-radiation-oncology>]

BSON –BSON is a computer data interchange format. The name “BSON” is based on the term JSON and stands for “Binary JSON”.. It is a binary form for representing simple or complex data structures including associative arrays (also known as name-value pairs), integer indexed arrays, and a suite of fundamental scalar types. BSON originated in 2009 at Mongo DB.[Source – bsonspec.org] && [Source – Wiki]

[III] [Ocaml+AI/ML+Coq Theorem Prover+q*cert-query compiler system+Java+BaseX-XML/Mongo DB- Data Base System] DICOM based Medical Image processing Algorithms for our R&D Platform :

GENERAL APPROACH TO PROBE RADIATION ONCOLOGY INFORMATICS USING OUR SOFTWARE HARDWARE FIRMWARE TO DESIGN DEVELOP & TEST A NOVEL MEDICAL INFORMATICS R&D FRAMEWORK



Do not forget to install and use DICOM

ALGORITHM I - MEDICAL INFORMATICS FRAMEWORK
 ACTUAL IMPLEMENTATION WILL CERTAINLY VARY
 PLEASE CHECK & SATISFY YOURSELVES.
 THANKS - Dr.Nirmal
 Non-Profit R&D Only
 Simple Suggestion.
 Testing in Progress With some useful results in IoT/HPC Heterogeneous Environment/s
 Keep goin.....

[Figure I – Algorithm I – Our R&D Medical Informatics AI/ML Framework With Owl/JI Prolog]

[III] Related R&D Information on References involving – Mathematics+Software Used :

[a] <https://en.wikipedia.org/wiki/OCaml>

[b] OCaml-Java: The Java Virtual Machine as the target of an OCaml compiler*

[Source : DOI: <https://doi.org/10.1017/S0956796816000095> /Published online by Cambridge University Press: 17 May 2016]

[c] <https://www.jikesrvm.org/> – JikesRVM – [RVM-Research Virtual Machine]

[d] http://www.vixra.org/author/nirmal_tej_kumar

[e] *basex.org* – BaseX is a robust, high-performance XML database engine and a highly compliant XQuery 3.1 processor with full support of the W3C Update and Full Text extensions. BaseX is very light-weight. It can be run and used in lots of different ways, such as a Standalone Application, using the Graphical User Interface or the Command-Line Client.

[f] viewbox.sourceforge.net/dicJava.html && <https://sourceforge.net/projects/dcm4che>

[g] <https://saravansubramanian.com/extractdicomimagedata>

[h] javadicomtoolkit.com

[i] <https://www.thanassis.space/score4.html> – Functional languages (like LISP, OCaml, Haskell, etc) are reputed to allow concise, expressive solutions to artificial intelligence problems .

[j] <https://github.com/TheButlah/BatlCaml> – Ocaml AI Information – Could be useful.

[k] <https://ocamlnews.blogspot.com/2010/05/artificial-intelligence-neural-networks.html>

[l] <https://libraries.io/search?keywords=ai,akka&languages=OCaml>

[m] <https://www.thekerneltrip.com/ocaml/ocaml-owl> – Machine Learning+Scientific Computing. && ocaml.info/software.html

[n] <https://blog.janestreet.com/deep-learning-experiments-in-ocaml>

[o] <https://mongodb.github.io/mongo-java-driver/> – The official MongoDB Java Driver providing both synchronous and asynchronous interaction with MongoDB.

[p] <https://www.mongodb.com/> – MongoDB is a general purpose, document-based, distributed database built for modern application developers and for the cloud era.

https://www.tutorialspoint.com/mongodb/mongodb_java.htm

<https://www.javatpoint.com/java-mongodb>

<https://www.javatpoint.com/mongodb-tutorial>

<https://www.semanticscholar.org/author/Nirmal-Tej-Kumar/12354503/suggest>

https://webcourse.cs.technion.ac.il/236873/Winter2013-2014/ho/WCFiles/Algebra_IP.pdf – Linear Algebra & Image Processing – Vectors and Matrices•Vector Spaces•Eigenvalues and Eigenvectors•Digital Images – Basic Concepts•Histograms•Spatial Filtering.

Additional Information on Java/XML/CAML/Ocaml/Owl :

[a] <https://www.w3schools.com/xml>

[b] www.java.com

[c] <https://caml.inria.fr>

[d] <https://docs.microsoft.com/en-us/sharepoint/dev/schema/query-schema>

[e] <https://ocaml.org> && <https://devmesh.intel.com/projects/owl-an-ocaml-numerical-library>
<https://github.com/ryanrhymes/owl>

[f] <https://github.com/querycert/qcert> - This is the source code for Q*cert, a framework for the development and verification of query compilers. It supports a rich data model and includes an extensive compilation pipeline 'out of the box'. Q*cert is built using the Coq proof assistant (<https://coq.inria.fr>). A significant subset of the provided compilation pipeline has been mechanically checked for correctness.

[g] <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.

[IV] Acknowledgment/s :

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[THE END]