

# **[ IMAGEAI/IoT/HPC/Hardware/Software/Firmware ] based Novel Design of Next Generation Hybrid Heterogeneous Medical Imaging Platforms R&D Using Theorem Provers like Z3Py - A Short Technical Notes & Simple Suggestion.**

[ Exploring (Imaging Mathematics+Hardware Mathematics) for Next Generation Artificial Intelligence(AI) based Medical Imaging Applications ]

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## **Abstract :**

It was proposed and we are presenting an Interesting Informatics Platform based on [ IMAGEAI-Python AI Library + Python Theorem Prover/s ( like **Z3Py : the Z3 API in Python**) ] in the Context of [ Image J/Fiji/Bone J/Java Virtual Machine )/JikesRVM - Research Virtual Machine/GCSpy Tool/Compiler DNA Techniques ] Using **Imaging Mathematics+Hardware Mathematics** w.r.t [ Java/Jython/Python ] involving Challenges of Advanced Medical Image Processing.

A simple approach is shown as a block diagram below for further investigations and to inspire our readers to come up with more rigorous approaches in the near future. Not all details are presented in this communication.

**key words : { JikesRVM/Z3Py/Ivy/IMAGEAI/Python/Jython/Java/IoT/HPC/ImageJ/Fiji/BoneJ/ Medical Image Processing }**

## [I] Inspiration & Introduction :

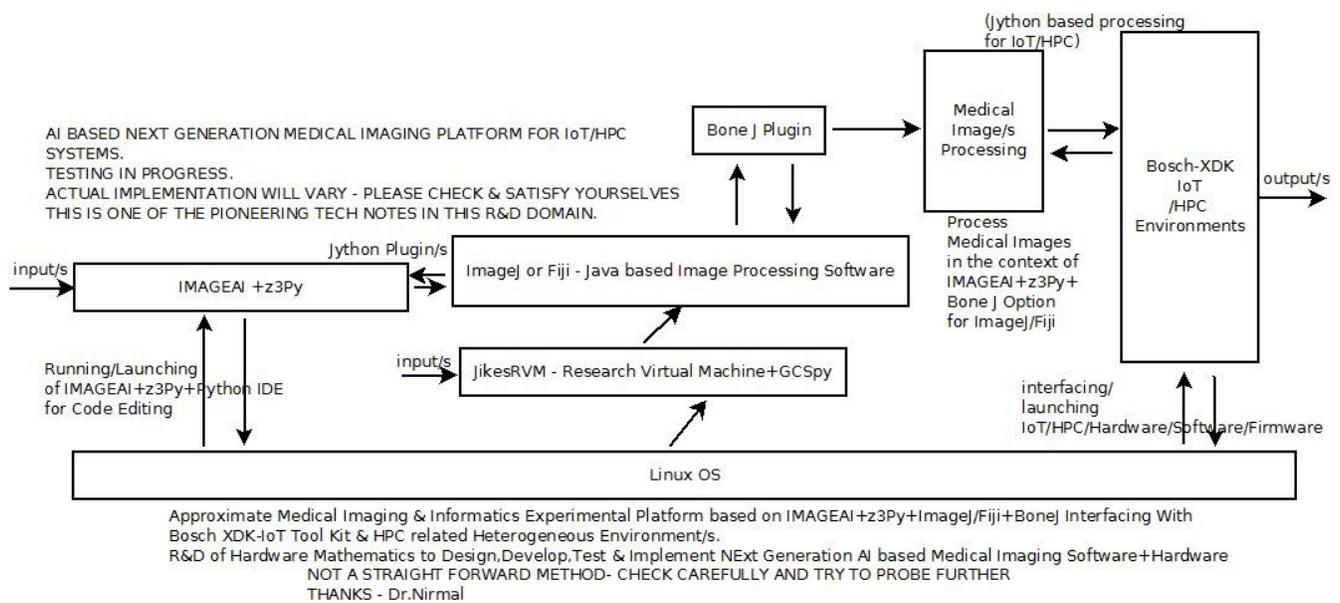
Doube M, Kłosowski MM, Arganda-Carreras I, Cordelières F, Dougherty RP, Jackson J, Schmid B, Hutchinson JR, Shefelbine SJ. (2010) BoneJ: free and extensible bone image analysis in ImageJ. *Bone* 47:1076-9. doi: [10.1016/j.bone.2010.08.023](https://doi.org/10.1016/j.bone.2010.08.023)

<https://semiengineering.com/artificial-intelligence-chips-must-get-the-floating-point-math-right/>

<https://www.synopsys.com/designware-ip/technical-bulletin/hardware-mathematics-for-ai-dwtb-q318.html>

<https://towardsdatascience.com/the-story-and-future-of-imageai-one-year-anniversary-e63c80f527c8>

## [II] (Python+Jython+Java+Z3Py) based R&D Informatics Framework Implementation :



[ Figure I – Experimental Idea Involving (IMAGEAI+Z3PyTheorem Prover+ImageJ/BoneJ+IoT/HPC) in the Context of Testing our Proposed Medical Imaging R&D Platform ]

### Simple Procedure to TEST our Algorithm :

- [a] Understand IMAGE AI & Z3Py Theorem Prover
- [b] Understand ImageJ/Fiji + BoneJ Option +Jython Plugin design concepts. JikesRVM is bit tricky.
- [c] Understand Bosch-XDK-IoT *HPC related concepts – Hardware/Software/Firmware*
- [d] May not be a straight forward approach for some.If JikesRVM is not OK,then Please try some other JVM.Hardware/Software issues presented from our side is only for guidance. Please check your requirements.We are not recommending any Hardware/Software.

### [III] My Acknowledgment/s :

{ Special Thanks to all WHO made this happen in my LIFE. Non-Commercial R&D Only. }

### [IV] Related [R&D] Information on Mathematics & Software Used :

- [a] <http://bonej.org/> && <https://imagej.nih.gov/ij/> && <https://fiji.sc/>
- [b] <https://github.com/alexandre77/img-prolog>
- [c] <https://www.spiedigitallibrary.org/...Prolog...image-processing/.../12.223983...>
- [d] [https://www.researchgate.net/.../302120341\\_Intelligent\\_Image\\_Processing\\_U...](https://www.researchgate.net/.../302120341_Intelligent_Image_Processing_U...)
- [e] <https://www.tib.eu/.../PIP-an-integrated-Prolog-image-processing-enviro...>
- [f] [https://link.springer.com/content/pdf/10.1007/978-1-84996-169-1\\_23.pdf](https://link.springer.com/content/pdf/10.1007/978-1-84996-169-1_23.pdf)
- [g] [www.jiprolog.com/](http://www.jiprolog.com/)
- [h] <https://www.swi-prolog.org/Download.html>
- [i] <https://github.com/jiprolog/jiprolog/wiki/Prolog-calls-Java>
- [j] <https://books.google.co.in/books?isbn=813171134X>
- [k] <http://imageai.org/> && <https://pypi.org/project/imagej/> && <https://github.com/imagej/pyimagej>
- [l] [www.bristol.ac.uk/wolfson-bioimaging/.../image-analysis/image-j--fiji/](http://www.bristol.ac.uk/wolfson-bioimaging/.../image-analysis/image-j--fiji/) && <https://loci.wisc.edu/software/fiji>
- [m] <https://www.jikesrvm.org/> - **JikesRVM – Research Virtual Machine for R&D.**
- [n] <https://github.com/JikesRVM/JikesRVM>
- [o] <https://www.semanticscholar.org/paper/Implementing-a-High-Performance-Object-Transfer-Chaumette-Grange/92e51f29ad6b047d4019fab10a880cb06687497d>
- [p] <https://www.semanticscholar.org/author/Nirmal-Tej-Kumar/12354503/suggest>
- [q] [https://imagej.net/Jython\\_Scripting](https://imagej.net/Jython_Scripting)
- [r] [marcora.caltech.edu/jython\\_imagej\\_howto.htm](http://marcora.caltech.edu/jython_imagej_howto.htm)

[s] <https://staff.washington.edu/jon/flip/www/> - Information on Python based Theorem Provers.

[t] <https://arxiv.org> > cs

[u] <https://github.com/evhub/pyprover>

[v] <https://www.stephanboyer.com/post/.../automated-theorem-proving-in-pyth>

[w] <https://www.cs.tau.ac.il/~msagiv/courses/asv/z3py/guide-examples>.

[x] <https://developer.ibm.com/tutorials/ba-metaprogramming-python/>

[y] [why3.lri.fr/](http://why3.lri.fr/)

[z] <http://vixra.org/abs/1907.0605> – Nirmal Tej Kumar.

## [ V ] Special Information on Z3 API in Python Used in our R&D :

“ Z3 API in Python - Z3 is a high performance theorem prover developed at [Microsoft Research](#). Z3 is used in many applications such as: software/hardware verification and testing, constraint solving, analysis of hybrid systems, security, biology (in silico analysis), and geometrical problems.”

<https://github.com/Z3Prover/z3> && <https://ericpony.github.io/z3py-tutorial/guide-examples.htm>

[ <https://www.cs.tau.ac.il/~msagiv/courses/asv/z3py/guide-examples.htm> ]

[ <https://github.com/Microsoft/ivy> ]

[ <https://theory.stanford.edu/~nikolaj/programmingz3.html> ]

[ <https://rise4fun.com/Z3/tutorial/guide> ]

## [VI] Special Information on IMAGEAI – An AI Python Library Used in our R&D :

“ **ImageAI** is an easy to use Computer Vision Python library that empowers developers to easily integrate state-of-the-art Artificial Intelligence features into their new and existing applications and systems. It is used by thousands of developers, students, researchers, tutors and experts in corporate organizations around the world. You will find below features supported, links to official documentations as well as articles on **ImageAI**.”

“ **ImageAI** provides API to recognize 1000 different objects in a picture using pre-trained models that were trained on the ImageNet-1000 dataset. The model implementations provided are SqueezeNet, ResNet, InceptionV3 and DenseNet. “

“ **ImageAI** provides an extended API to detect, locate and identify 80 objects in videos and retrieve full analytical data on every frame, second and minute. This feature is supported for video files, device camera and IP camera live feed. “

[ <http://imageai.org/> ]

**[VII] R&D References (((via))) Vixra.org :**

[a] [http://vixra.org/author/nirmal\\_tej\\_kumar](http://vixra.org/author/nirmal_tej_kumar)

[b] [vixra.org/author/nirmal](http://vixra.org/author/nirmal)

[c] [vixra.org/author/d\\_n\\_t\\_kumar](http://vixra.org/author/d_n_t_kumar)

[d] [vixra.org/author/dnt\\_kumar](http://vixra.org/author/dnt_kumar)

[e] <https://www.vixra.org/abs/1709.0412>

[f] [vixra.org/author/n\\_t\\_kumar](http://vixra.org/author/n_t_kumar)

[g] <http://vixra.org/abs/1709.0376>

**[ THE END ]**