The Importance of Quaternions & Rotational Systems in the Context of Cryo-EM Image Processing – A Simple Suggestion On Using HOL/JVM/JikesRVM/Image J Based Computing Environments.

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Our Main Idea & Inspiration :

As the title suggests it is our sincere desire to explore "Quaternions & Rotational Systems" in the highly promising domains of Cryo-EM Image Processing to probe the frontiers of Nano-Bio Systems.

Introduction :

An in-depth analysis of cryo-EM Imaging and applications could be found in :

Understanding JikesRVM in the Context of Cryo-EM/TEM/SEM Imaging Algorithms and Applications – A General Informatics Introduction from a Software Architecture View Point.

Article(PDF Available)·January 2016 / DOI: 10.5958/0975-8089.2016.00001.4} from Research Gate.

Quaternions :

"In mathematics, the **quaternions** are a number system that extends the complex numbers. They were first described by Irish mathematician William Rowan Hamilton in 1843 and applied to mechanics in three-dimensional space. A feature of quaternions is that multiplication of two quaternions is non-commutative. Hamilton defined a quaternion as the quotient of two directed lines in a three-dimensional space or equivalently as the quotient of two vectors".

"Quaternions find uses in both pure & applied mathematics, in particular for calculations involving three-dimensional rotations such as in three-dimensional computer graphics,computer vision, and crystallographic texture analysis". **[Source : Wiki.]**

Cryo-EM Image Processing Technique :

"Cryo-electron microscopy (cryoEM) is an ensemble of techniques allowing the observation of biological specimens in their native environment at cryogenic temperatures in EM (-180°C for liquid nitrogen stages, -269°C for He)."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4441764/ - >>> **Cryo-EM: A Unique Tool for the Visualization of Macromolecular Complexity.**

[Source : http://cryoem.berkeley.edu/cryoem]

Informatics Implementation :

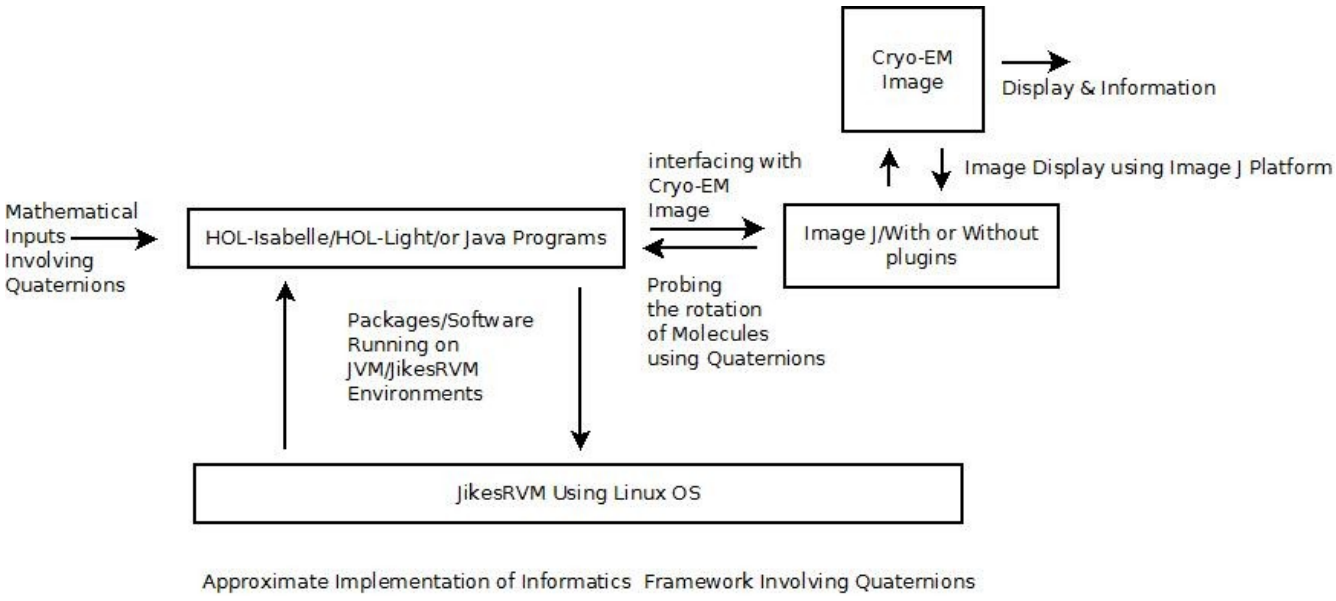

Figure I – Approximate Informatics Framework involving Quaternions to Probe Cryo-EM Images.A suggestion only – Actual implementation could vary to some extent.

This 'Short Technical Communication' is based on all the main references & references/notes presented in Additional Information section.Please *check all the operational manuals/tutorials of Software/HOL/ HOl-Light/Image J platform/Other related libraries before using them.Written in free style.No specific format/s were followed.*

Image J platform could be obtained from : https://imagej.nih.gov/ij/

Concluding Remarks :

As mentioned above in the TITLE – a simple suggestion was defined designed and is being tested. Hope this work will inpsire all those researchers in the promising field of Cryo-EM Image Processing and its applications.

Additional Information :

[i] https://web.math.unifi.it/~maggesi/talks/2017-09-27-itp2017.pdf

[ii] https://www.isa-afp.org/

[iii] http://isabelle.in.tum.de/ ; https://www.cl.cam.ac.uk/~jrh13/hol-light/

[iv] https://www.chemistryworld.com/news/explainer-what-is-cryo-electron-microscopy/3008091.article

[v] https://web.ma.utexas.edu/users/hadani/publications.htm

[vi] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3505076/

[vii] https://www.sciencedirect.com/science/article/pii/S030439759800228X - Formalizing mathematics in higher-order logic: A case study in geometric modelling.

[viii] Formalizing Image Processing in Higher Order Logic(hol) by Understanding and Using XML-HolScala-JVM Software Framework Towards Processing of Cryo-Em/tem/sem Images Based on Levy Processes a Novel Suggestion - [http://vixra.org/abs/1709.0412]

[ix] https://www.biorxiv.org/content/biorxiv/early/2017/07/28/154211.full.pdf

Acknowledgment/s :

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References :

[1] http://www.chrobotics.com/library/understanding-quaternions

[2] https://en.wikipedia.org/wiki/Quaternion

[3] https://introcs.cs.princeton.edu/java/32class/Quaternion.java.html

[4] https://github.com/libgdx/libgdx/blob/master/gdx/src/com/badlogic/gdx/math/Quaternion.java

[5] http://cryoem.berkeley.edu/cryoem

[Dated : 10th of November 2018.]

THE END