Shibom Basu

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PROFILE

PhD student in Computational Biophysics, focused on Time-resolved X-ray crystallography, and associated algorithm development, data mining and analysis. Areas of expertise include:

1. Analyzed millions of diffraction images (total of > 100 TB per experiment) processing to reconstruct 3D model of bio-molecules
2. 4 years of experience in working with big data, data reduction, processing, and statistical analysis
3. Experiences of Python programming, debugging, MATLAB, Bio-python, UNIX, and Linux
4. Debugging experience and understanding of C and C++ languages, and knowledge of R programming
5. Experience in feature extraction, clustering, logistic regression, Regularization, bag-of-words, classification of data, error analysis, and other machine learning algorithms
6. Basic knowledge and experience about SQL queries, NoSQL or Map/Reduce
7. Performed K-means Clustering, feature histogramming, and applied Random-forest classifier in colonoscopy image processing for Polyp tumor detection
8. Wrote plenty of python codes to analyze/visualize and read out the image data, collected at the detector; codes are posted in GitHub repository (https://github.com/shibom)
9. Certified in Machine-Learning course on Coursera by Prof. Andrew Ng (https://www.coursera.org/learn/machine-learning/home/welcome) (June-July, 2015)
10. Implemented machine learning algorithms (Gradient descent, Logistic regression, Regularization, Neural networks, Back-propagation, error analysis, learning curves, Support Vector Machine, anomaly detection, K-means, PCA analysis, collaborative filtering algorithm, Map/Reduce, stochastic gradient descent etc.) in MATLAB
11. 250+ total citations in 9 total research articles published, including articles in *Nature* and *Science* journals; https://scholar.google.com/citations?user=bSzceSoAAAAJ&hl=en
12. Working experience as a team with big international collaborative groups of hundreds of scientists

EDUCATION

Arizona State University (Expected – 2015 end)
PhD in Chemistry and computational chemistry
Research: Time-resolved crystallography using X-ray free electron laser (XFEL)
- Advisor: Dr. Petra Fromme, Arizona State University (ASU), Arizona, USA

Indian Institute of Technology (IIT) - Madras, India (2009 – 2011)
M.Sc. in Chemistry CGPA: **8.52/10**
- Research: Quantum dynamics study of proton and Oxygen molecule interaction
- Advisor: Dr. Sanjay Kumar, IIT-M, Chennai, India

PUBLICATIONS

1. Christopher Kupitz* and **Shibom Basu*** *et al.,* "*Serial time-resolved crystallography of photosystem II using a femtosecond X-ray laser*", **Nature**, **513**, 261 **(2014)**
2. Jason Tenboer, **Shibom Basu** *et al., "Time-resolved serial femtosecond crystallography captures high resolution intermediates of Photoactive Yellow Protein"*, **Science**, **6214**, 346 **(2014)**

3. Ganesh Subramaniam, **Shibom Basu**, Haiguang Liu, J.M. Zhou, John C. H. Spence, "*Solving Protein Nano-crystals by Cryo-EM diffraction: Multiple scattering artifacts*", **Ultramicroscopy**, **148**, 87 **(2014)**
4. Marius Schmidt, Kanupriya Pande, **Shibom Basu**, Jason Tenboer, *"Room temperature structures beyond 1.5 Å by serial femtosecond crystallography"*, **Structural Dynamics**, **2** (4), (**2015)**
5. Chelsie E. Conrad, **Shibom Basu**, *et al., "A novel inert crystal delivery medium for serial femtosecond crystallography"*, **IUCrJ, 2015 (In press)**
6. Jesse Coe, Christopher Kupitz, **Shibom Basu**, Chelsie E. Conrad, Shatabdi Roy-Chowdhury, Raimund Fromme, Petra Fromme, *"Chapter Twenty-Two-Crystallization of Photosystem II for Time-resolved Structural Studies Using an X-ray Free Electron Laser"*, **Methods in enzymology, 557**, 458-482 **(2015)**
7. HH Lee, Irene Cherni, H. Yu, **Shibom Basu** *et al.*, *"Expression, purification and crystallization of CTB-MPR, a candidate Mucosal vaccine component against HIV-1",* **IUCrJ, 1,** 305, (**2014**)
8. Uwe Weierstall, Daniel James, **Shibom Basu** *et al.,* "*Lipidic cubic phase injector facilitates membrane protein serial femtosecond crystallography",* **Nature Comm., 5**, 3309 **(2014)**
9. Wei Liu, Daniel Wacker, Cornelius Gati, **Shibom Basu**, *et al*., "*Serial Femtosecond Crystallography of G-Protein Coupled Receptors* ", **Science**. **1521**, 342 **(2013)**

EXPERIENCES

PhD Thesis (2011- current)– Time-resolved crystallography using X-ray free electron laser (XFEL)

- Analyzed millions of diffraction images (total of >100 TB) collected from each experiment at the XFEL
- Developed better method and worked with novel algorithms to efficiently reduce the data amount
- Processed those diffraction images to reconstruct 3D structural model of the bio-molecules
- Made statistical interpretation from those diffraction images and unraveled the structural insights
- Wrote plenty of python codes to analyze/visualize and read out the image data, collected at the detector, codes are posted in GitHub repository.
- Debugged, added features and customized the existing software packages (written in C and C++) to analyze specific type of data

Training (May, 2015 at the LCLS, Stanford)

- Spent one month for getting trained and learned about technical details of running a beamline at CXI instrument at the LCLS, Stanford. During this period, wrote a python code to convert the detector metrology to a usable format and learned how to code up in python to design control system to run a X-ray optics device.

CSE-591 class project (Jan-2015) – Polyp detection from Colonoscopy images

- Performed feature extraction from colonoscopic image data
- Performed K-means Clustering, feature histogramming, and applied Random-forest classifier
- Performed Bag-of-words approach on colonoscopy images to detect informative and non-informative ones
- Trained a neural network to classify images with polyp and non-polyps.
- Learned Theano python package to do tensor operations in the deep-learning codes of neural networks
- All codes are posted in the GitHub repository.

Machine-Learning course on Coursera by Prof. Andrew Ng (https://www.coursera.org/learn/machine-learning/home/info) (June-2015)

- Learned many machine learning algorithms (Gradient descent, Logistic regression, Regularization, Neural networks, Back-propagation, error analysis, learning curves, Support Vector Machine, anomaly detection, K-means, PCA analysis, collaborative filtering algorithm, MapReduce, stochastic gradient descent etc.)
- Implemented all these algorithms using MATLAB and codes are posted in GitHub repository.

M.Sc. Thesis (2010-11) – Quantum dynamics study of proton and Oxygen molecule interaction

- Solved time-dependent Schrodinger equation in analytical method to study the ultrafast process
- Wrote codes in FORTRAN language to diagonalize matrix, wave-packet movement, and solve Schrodinger equation using Chebyshev polynomials and for other quantum mechanical calculations

Summer project (2010) – Homology modeling of ABF family of transcription factors

- Used plenty of different modeling packages (modeller, Rossetta, Swiss-Model, YASARA etc.) to model the protein and DNA molecules
- Performed protein sequence alignment using Hidden Markov Model
- Performed docking of protein onto DNA molecules using Z-DOCK

Talk and presentations

1. Basu S. (03.17.2015). West Coast Protein Crystallography Workshop. Session 7 (Membrane Proteins). Monterey, California, USA (Talk)
2. Basu S. (07.28.2014). Diffraction methods in Biology, Gordon Research Conference, Maine, USA (Poster)
3. Basu S. (01.02.2014). Western Photosynthesis Conference. Session 4 (Photosystem and Reaction Centers). Asilomar conference ground. Pacific Groove, Monterey, California, USA (Talk)
4. Basu S. (09.16.2013). X-ray Lasers in Biology. The Royal Society, London and Chichelly, UK (Poster)
5. Basu S. (06.22.2013). American Crystallographic Association. Program No. 11.03, Honolulu, Hawaii, USA (Poster)
6. Basu S. (06.17.2013). International Photo-crystallographic workshop. University at Buffalo, SUNY, Amherst Campus, Buffalo, USA (Poster)
7. Basu S. (04.12.2013). Arizona Student Energy Conference. University of Arizona, Tucson, Arizona, USA (Poster)
8. Basu S. (06.21.2012). Ultrafast X-ray Summer School. Stanford Linear Accelerator Center (SLAC). Palo Alto, California, USA (Poster)
9. Basu S. (05.15.2012). Physics, Chemistry, and Biology of Membrane Protein. Arizona State University. Tempe, Arizona, USA (Poster)

Awards

- Travel Award, International Photo-crystallographic conference, SUNY, Buffalo, June 17, 2013
- Best Poster Award, Arizona Student Energy Conference, U of Arizona, April 12, 2013
- Best Poster Award on innovative idea for the new type of experiment at the LCLS, Ultrafast X-ray Summer School, SLAC, June 21, 2012

References

- Available upon request