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The NIH/NIGMS Center for Integrative Biomedical Computing

The Center for Integrative Biomedical Computing (CIBC) is dedicated to producing open-source software tools for biomedical image-based modeling, biomedical simulation and estimation, and the visualization of biomedical data. The Center works closely with software users and collaborators in a range of scientific domains to produce user-optimized tools and provides advice, technical support, workshops, and education to enhance user success. Biological projects and collaborations drive our development efforts, all with a single unifying vision: to develop the role of image-based modeling and analysis in biomedical science and clinical practice.

BTR Portal Software Dissemination
A one stop shop for all innovative technology resources supported by the NIGMS and NIBIB, categorized, updated, and maintained by participating centers.

Upcoming Events

July 11-21, 2016
Summer Course on Image-based Biomedical Modeling (IBBM)
2015 Image-Based Biomedical Modeling (IBBM) summer course
The Image-Based Biomedical Modeling (IBBM) summer course was held July 13-23 in Newpark, Park City (Utah). The two-week course included the following activities: Didactic lecture sessions given by the three PIs as well as four invited instructors and experts...

2014 Summer Course on Image-based Biomedical Modeling (IBBM)
The Image-Based Biomedical Modeling (IBBM) summer course was held from July 14 to July 24 in the Newpark Hotel, Park City, Utah. The two-week summer course hosted 39 participants this year: 31 graduate students, 1 MD/PhD student, 2 postdoctoral fellows, 3...

Neuro Stimulation
There has been a recent explosion of interest in the use of noninvasive transcranial brain stimulation (or "neurostimulation"), both in clinical settings and as a research tool. One of the two main ways to stimulate the brain transcranially is to run a...
Future of Biomedical Computing

Data Size and Integration

Uncertainty and Variability

Imaging and Personalized Medicine
Center Vision

Introduction
Center Vision
Center Vision

Introduction
# Software Downloads > 170K

<table>
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<tr>
<th>Software</th>
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<tr>
<td>SCIRun</td>
<td>45,290 (since 2004)</td>
<td>590</td>
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<tr>
<td>Seg3D</td>
<td>41,643 (since 2007)</td>
<td>148</td>
</tr>
<tr>
<td>ImageVis3D</td>
<td>28,713 (since 2008)</td>
<td>28</td>
</tr>
<tr>
<td>Mobile (App Store)</td>
<td>42,693 (since 2009)</td>
<td>1,898</td>
</tr>
<tr>
<td>map3d</td>
<td>8,147 (since 2004)</td>
<td>54</td>
</tr>
<tr>
<td>ShapeWorks</td>
<td>3,970 (since 2009)</td>
<td>271</td>
</tr>
<tr>
<td>FluoRender</td>
<td>483 (since 2014)</td>
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Software Wikipedia Pages

Introduction
CIBC Software Strategy

1999 - 2005

2002: Development of PowerApps:
CIBC Software Strategy
2015 - 2020
Training Impact: Since 2009

Postdoctoral Fellows:
• Jeroen Sinstra—Research Staff Scientist, Numira Biosciences, Inc.
• Josh Levine—Assistant Professor of Computing Science, Clemson University
• Erik Anderson—Research Scientist, EGI
• Paul Rosen – Research Assistant Professor of Computer Science and SCI Institute
• Yaniv Gur – IBM
• Moritz Dannauer – Postdoctoral fellow
• Shireen Elhabian – Postdoctoral fellow
• Shankar Sastry – Postdoctoral fellow

Graduated PhD Students:
• Fangxiang Jiao – TGS
• Burak Erem – Postdoc, Boston Children’s Hospital
• Dafang Wang – Post Doctoral Fellow, Johns Hopkins University
• Sarah Geneser—Medical Physics Resident, UCSF
• Sila Kurugol - Postdoc, BWH, then Postdoc, Boston Children’s Hospital
• Josh Cates—Research Scientist CARMA and SCI Institute
• Darrell Swenson – L3
• Greg Gardner – Medical School
• Jonathan Bronson – Google
• Zhisong Fu - SYSTAP, LLC
Introduction

Training Impact (Cont.)

Graduate Students:
• Jaume Coll Font – Ph.D. student at NEU
• Seyhmus Guler - Ph.D. student at NEU
• Jess Tate - Ph.D. student at SCI
• Shridharan Chandramouli – Ph.D. student at SCI
• Jessie France – Ph.D. student at SCI
• Alexandra Warner – Ph.D. Student at SCI
• Ramon Martinez Orellana – Visiting student, Technical University of Catalonia
• Marc Queralt Madrigal - Visiting student, Technical University of Catalonia

Undergraduate Students:
Current:
• Max Hansen
• Karli Gilette
• Rebecca Pennock
• Thomas Robertson
• Spencer Frisby
• Benjamin Larson
• Collin Tate
• Angels Rates Borras

Previous:
• Myron Lance - Medical school
• Andrew Miller - graduating 2015
• Alex Gerber - junior BME student
• Minna Wang - junior BME Student
• Ahrash Poursaid - graduating 2015
• Kenneth Louie - junior BME student
• Biel Roig i Solvas – now MS at NU
• Delia Fernandez Canellas - Technical University of Catalonia
• Paula Gonzalez Navarro – now PhD at NU
Center Impact

NIH/NCRR Center
Awarded for 3 years.
Sept, 1999

NIH/NCRR Center
Renewal for 3 years.
Sept, 2002

NIH/NCRR CIBC
Renewal for 5 years
Feb. 2005

NIH/NCRR CIBC
Renewal for 5 years,
July 2010

2015

46 Publications
First Workshop
map3d v3.0 - 6.2
BioPSE/SCIRun v1.0.0 - v1.6.0

49 Publications
Second Workshop
map3d v6.4 - 6.5
BioPSE/SCIRun v1.20.0
First release:
BioFEM
BioTensor
BioImage

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Second Workshop
BioPSE/SCIRun v1.20.0 - v4.2
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BioImage
New BioMesh3D
map3d v6.4 - 6.5
ImageVis3D v1.0
Seg3D v1.12
ShapeWorks

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132 Publications
13 Workshops
NIH/BTR Portal
BioPSE/SCIRun v4.2 - v4.7
SCIRun v5.0 alpha
BioMesh3D
BioMesh3D Client v1.0
BrainStimulator
Forward/Inverse Toolkit
map3d v7.1
ImageVis3D v2.0.1 - v3.1
Seg3D v2.15
ShapeWorks v0.3.0 - v1.2
Cleaver v2.0
Center Impact

SINCE OUR LAST RENEWAL IN 2009:

Software Impact - Average 250% increase in software downloads

• Over 15,000 downloads of SCIRun, (all from outside the Center and our affiliate institutions)

• Over 15,000 downloads of Seg3D,

• Over 7000 downloads of the CIBC data sets.

• Over 23,800 downloads of ImageVis3D and ImageVis3D Mobile.

Publication Impact - 33% Increase

• Over 300 papers published by scientists outside the Center referencing CIBC software

• Center members have authored over 140 publications related to biomedical computing in a wide range of technical and biomedical journals and conference proceedings.
Updated Center Impact

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141 Publications
14 Workshops
NIH/BTR Portal
BioPSE/SCIRun v4.2 - v4.7
SCIRun v5.0 Pre Release
map3d v7.2.1
ImageVis3D v2.0.1 - v3.1
Seg3D v2.2.1
ShapeWorks v0.3.0 - v1.2
Cleaver v2.0
Research Cluster Organization

Biomedical Research Clusters

- Biomechanics and Blood Flow
  - Heath Henninger
  - Kent Bacchus
  - Murat Maga
  - Alison Marsden (UCSD)
  - Jeff Weiss (Utah)
  - Sandra Shefelbine
  - Michael Okun/Kelly Foote (U Florida)
  - Alvaro Pascual-Leone (Harvard)
  - Don Tucker (U Oregon/EGI)

- Microscopy and Small Scale Imaging
  - Gabrielle Kardon (Utah)
  - Bryan Jones
  - Rai Winslow (JHU)
  - Peter van Dam
  - Nassir Marrouche (Utah)
  - Gernot Plank
  - Natalia Trayanova (JHU)
  - Petr Stovicek

- Neuromodulation and Brain Source Localization
  - Alvaro Pascual-Leone (Harvard)
  - Jeffrey Ojemann
  - Tom Pilcher
  - Dagmar Sternad
  - Brad Manor

- Cardiac Arrhythmia and Ischemia
  - Gabrielle Kardon (Utah)
  - Bryan Jones
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  - Peter van Dam
  - Nassir Marrouche (Utah)
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  - Petr Stovicek

Collaborators

- DBPs
- Morgan Anderson
- Doug Brown
- Allison Marsden (UCSD)
- Jeff Weiss (Utah)
- Sandra Shefelbine
- Michael Okun/Kelly Foote (U Florida)
- Alvaro Pascual-Leone (Harvard)
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Natalia Trayanova (JHU)
Petr Stovicek
Introduction

DBP Partners

Microscopy and Small Scale Imaging
- Rai Winslow, PhD, John’s Hopkins University
- Gabrielle Kardon, PhD, University of Utah

Biomechanics and Blood Flow
- Alison Marsden, PhD, Stanford University
- Jeffrey Weiss PhD, Andrew Anderson PhD, University of Utah

Neuromodulation and Brain Source Localization
- Don Tucker, PhD, University of Oregon and EGI
- Michael Okun, MD and Kelly Foote, MD, University of Florida
- Pascual-Leone, MD, Harvard Medical School

Cardiac Arrhythmias and Ischemia
- Natalia Trayanova, PhD, John’s Hopkins University
- Nassir Marrouche MD, University of Utah
New Budget and Reporting Cycle

Old Budget and Reporting Cycle:

- New Year: August 1
- Year End: July 31
- Annual Report Due: June 1

New Budget and Reporting Cycle:

- New Year: May 1
- Year End: April 31
- Annual Report Due: March 1
During the discussion, the review panel was most enthusiastic about
TRD-2 (Visualization) and TRD-3 (Simulation and estimation. In
evaluating TRD-2, they appreciated the increasing need to better
visualize large data sets, and their uncertainties. They saw the
visualization TRD-2 as well positioned to support the other
TRDs, and the investigators uniquely qualified and considered
pioneers in biomedical visualization field. But the review
panel’s was slightly dampened as the TRD-2 did not mention
any multi-channel visualization.

They also thought that there was insufficient evaluation of the
visualization tools to measure success, another minor weakness
for TRD-2.
# Schedule

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