CENTRE FOR INTELLIGENT MACHINES (CIM)

Centre de recherche sur les machines intelligentes

www.cim.mcgill.ca

Annual Report 2012

**Draft**

Director

Professor Benoit Boulet

boulet@cim.mcgill.ca
SUMMARY ........................................................................................................................... 3
Section I – MEMBERSHIP .................................................................................................. 5
Section II – FUNDING INITIATIVES and AWARDS ......................................................... 7
Section II – PUBLICATIONS ............................................................................................ 8
SUMMARY

The McGill Centre for Intelligent Machines (CIM) is a multi-disciplinary, inter-departmental, inter-faculty research group formed in 1985 to provide an enriched mentoring and training environment for graduate students studying in the field of robotics and intelligent systems.

For almost 3 decades, CIM has been a pioneering force in cross-disciplinary research. The Centre is primarily located in contiguous space where labs and student offices are shared. CIM’s membership and students have been universally recognized over the years for their highest standards of excellence - exceptional scientific achievements and outstanding contributions to society and industry.

CIM’s management design and organizational structure have been studied, emulated and adopted by various units, both within the university and outside of McGill, notably in the academic sector. CIM continues to be regarded by its peers as a model for “best practices” in a world now heavily populated by research organizations.

The Centre celebrated its 25th Anniversary with an international guest speaker series and a scientific symposium.

For the year 2012:

The Centre was comprised of 19 members from both the Faculties of Engineering and Science -- the Department of Electrical and Computer Engineering, Department of Mechanical Engineering and the School of Computer Science. CIM also has 13 associate members representing a diversity of research collaborations, such as within the Faculty of Medicine -- the Royal Victoria Hospital and the Montreal Neurological Institute.

The Centre was home to a diverse population of about 160 **graduate students, post-docs, research assistants and associates, as well as visiting scholars and undergraduate students from various disciplines.

<table>
<thead>
<tr>
<th>PhD</th>
<th>Master’s</th>
<th>U/Grads</th>
<th>Post-Docs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>69.5</td>
<td>48.5</td>
<td>16</td>
<td>7</td>
<td>145</td>
</tr>
</tbody>
</table>

The CIM members were collaborators and co-collaborators in grants and contracts totally about $550M.

**REPARTI** - Regroupement pour l’étude des environnements partagés intelligents répartis


Centre REPARTI is a $2.4M inter-institutional, interdisciplinary collaborative venture comprised of 8 Quebec institutions, 33 members and over 200 students. The McGill node of REPARTI is represented by 14 members from the McGill Centre for Intelligent Machines (CIM). The members of the McGill node collaborate in grants and contracts valued in excess of $5M.
The institutions participating in REPARTI are - Université Laval (host institution), McGill University, Université de Sherbrooke, École Polytechnique, Université de Montréal, Université du Québec à Chicoutimi and École de technologie supérieure (ÉTS).

Supported by the Quebec government’s Fonds de recherche Nature et technologies (FRNT), this regroupement stratégique builds on some unique precedents:

(1) The historical and concrete partnership that developed over the past 25 years between prominent researchers in U. Laval and McGill (CIM) as a result of the NSERC National Centres of Excellence program, the interuniversity-industrial consortium IRIS-Precarn, and the FQRNT Réseau QERRAnet.

(2) The long and productive relationship established between the McGill Centre for Intelligent Machines (CIM) and the Quebec government through the former FCAR Centre de recherche programme.

The formal renewal process for REPARTI began in the year 2012, and results of the competition will be announced in April 2013.

**NEW MEMBER**

**Professor Paul Kry became a member of CIM in 2012**

CIM welcomed Professor Paul Kry as a full member in 2012. His research interests include computer graphics, physically based animation, skin deformations of articulated characters, motion capture, interaction, and physically based modeling of humans and animals. He is specifically interested in human and animal motor control (e.g., locomotion, grasping, manipulation) in combination with natural phenomena such as the physics of rigid objects, deformation, and contact. Some areas of application in his work include computer animation for video games and movies, training simulations, ergonomics, and biologically inspired robotics and programming by demonstration. An important aspect of Prof. Kry’s work is the combination of real world measurements, approximate models, and physically based simulation. His research interests expand to machine learning, numerical methods, and audio.

A native of Ottawa, Prof. Kry moved to Waterloo in 1992 to attend the University of Waterloo where he obtained a B.Math. in computer science with electrical engineering electives (1997). His undergraduate studies included a one year exchange to Compiègne, France which included a six month work term in Paris. Upon graduation, he worked for Televitesse (now known as March Networks) before moving to Vancouver for graduate studies at the University of British Columbia. There, he obtained a M.Sc. (2000) and Ph.D. (2005) in computer science with his supervisor Dinesh K. Pai. While studying as a PhD in UBC, he followed Prof. Pai to New Jersey in 2002 to complete his research program at Rutgers University. After finishing he moved directly to Grenoble for postdoctoral work with the EVASION group at INRIA Rhône Alpes and the LNRS at Université René Descartes. Prof. Kry arrived at McGill University as an Assistant Professor in January 2008.
## Section I – MEMBERSHIP

### FULL MEMBERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angeles, Jorge</td>
<td>Professor</td>
<td>Mechanical Engineering</td>
<td>Workman 452</td>
<td>(514)</td>
<td>angelesATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Arbel, Tal</td>
<td>Associate Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 425</td>
<td>(514)</td>
<td>arbelATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Boulet, Benoit</td>
<td>Associate Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 509</td>
<td>(514)</td>
<td>bouletATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Caines, Peter</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 512</td>
<td>(514)</td>
<td>petercATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Clark, James</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 422</td>
<td>(514)</td>
<td>clarkATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Cooperstock, Jeremy</td>
<td>Associate Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 424</td>
<td>(514)</td>
<td>jerATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Cortelezzi, Luca</td>
<td>Associate Professor</td>
<td>Mechanical Engineering</td>
<td>McConnell 369</td>
<td>(514)</td>
<td>cortlzATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Dudek, Gregory</td>
<td>Professor</td>
<td>Computer Science</td>
<td>McConnell 419</td>
<td>(514)</td>
<td>dudekATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Ferrie, Frank</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 441</td>
<td>(514)</td>
<td>ferrieATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Kovacs, Jozef</td>
<td>Associate Professor</td>
<td>Mechanical Engineering</td>
<td>Macdonald 163</td>
<td>(514)</td>
<td>kovacsATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Langer, Michael</td>
<td>Associate Professor</td>
<td>Computer Science</td>
<td>McConnell 329</td>
<td>(514)</td>
<td>langerATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Levine, Martin</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
<td>Workman 451</td>
<td>(514)</td>
<td>levineATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Mahajan, Aditya</td>
<td>Assistant Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 533</td>
<td>(514)</td>
<td>adityaDOTTmcgillDOTca</td>
</tr>
<tr>
<td>Michalska, Hannah</td>
<td>Associate Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 514</td>
<td>(514)</td>
<td>hannahDOTmichalskaATmcgillDOTca</td>
</tr>
<tr>
<td>Nahon, Meyer</td>
<td>Professor</td>
<td>Mechanical Engineering</td>
<td>McConnell 421</td>
<td>(514)</td>
<td>mnahonATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Pineau, Joelle</td>
<td>Associate Professor</td>
<td>Computer Science</td>
<td>McConnell 106N</td>
<td>(514)</td>
<td>jpineauATcscDOTmcgillDOTca</td>
</tr>
<tr>
<td>Sharf, Inna</td>
<td>Associate Professor</td>
<td>Mechanical Engineering</td>
<td>McConnell 214</td>
<td>(514)</td>
<td>isharfATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Siddiqi, Kaleem</td>
<td>Professor</td>
<td>Computer Science</td>
<td>McConnell 420</td>
<td>(514)</td>
<td>siddiqiATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Zsombor-Murray, Paul</td>
<td>Associate Professor</td>
<td>Mechanical Engineering</td>
<td>Workman 454</td>
<td>(514)</td>
<td>paulATcimDOTmcgillDOTca</td>
</tr>
</tbody>
</table>
### ASSOCIATE MEMBERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Unit</th>
<th>Office</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecere, Renzo</td>
<td>Associate Professor</td>
<td>Cardiac Surgery (RVH)</td>
<td>RVH S8-44</td>
<td>(514) 843-1463</td>
<td>renzoDOTcecereATmuhcDOTmcgillDOTca</td>
</tr>
<tr>
<td>Collins, Louis</td>
<td>Associate Professor</td>
<td>Neurology and Neurosurgery/Biomedical Engineering</td>
<td>MNI WB-315</td>
<td>(514) 398-4227</td>
<td>louisDOTcollinsATmcgillDOTca</td>
</tr>
<tr>
<td>Forbes, James Richard</td>
<td>Assistant Professor</td>
<td>Mechanical Engineering</td>
<td>Macdonald 156</td>
<td>(514) 398-9675</td>
<td>jamesDOTrichardDOTforbesATmcgillDOTca</td>
</tr>
<tr>
<td>Hayward, Vincent</td>
<td>Professor</td>
<td>Electrical and Computer Engineering</td>
<td>McConnell 440</td>
<td>(514) 398-5006</td>
<td>haywardATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Husty, Manfred</td>
<td>Professor</td>
<td>Geometry and CAD, University of Innsbruck, Austria</td>
<td></td>
<td>+43-512-507/6830</td>
<td>manfredDOThustyATuibkDOTacDOTat</td>
</tr>
<tr>
<td>Kry, Paul</td>
<td>Assistant Professor</td>
<td>Computer Science</td>
<td>McConnell 113N</td>
<td>(514) 398-2577</td>
<td>kryATcsDOTmcgillDOTca</td>
</tr>
<tr>
<td>Liu, Xue</td>
<td>Assistant Professor</td>
<td>Computer Science</td>
<td>Macdonald 318</td>
<td>(514) 398-1819</td>
<td>xueliuATcsDOTmcgillDOTca</td>
</tr>
<tr>
<td>Misra, Arun</td>
<td>Professor</td>
<td>Mechanical Engineering</td>
<td>Workman 455</td>
<td>(514) 398-6288</td>
<td>misraATcimDOTmcgillDOTca</td>
</tr>
<tr>
<td>Mongrain, Rosaire</td>
<td>Associate Professor</td>
<td>Mechanical Engineering</td>
<td>Macdonald 369</td>
<td>(514) 398-1576</td>
<td>roaireDOTmongrainATmcgillDOTca</td>
</tr>
<tr>
<td>Musallam, Sam</td>
<td>Assistant Professor</td>
<td>ECE/Dept. of Physiology</td>
<td>McConnell 645</td>
<td>(514) 398-1702</td>
<td>samDOTmusallamATmcgillDOTca</td>
</tr>
<tr>
<td>Panangaden, Prakash</td>
<td>Professor</td>
<td>Computer Science</td>
<td>McConnell 108</td>
<td>(514) 398-7074</td>
<td>prakashATcsDOTmcgillDOTca</td>
</tr>
<tr>
<td>Pike, Bruce</td>
<td>Professor</td>
<td>Neurology and Neurosurgery/Biomedical Engineering</td>
<td>MNI WB-315</td>
<td>(514) 398-1929</td>
<td>bruceDOTpikeATmcgillDOTca</td>
</tr>
<tr>
<td>Precup, Doina</td>
<td>Associate Professor</td>
<td>Computer Science</td>
<td>McConnell 326</td>
<td>(514) 398-6443</td>
<td>dprecupATcsDOTmcgillDOTca</td>
</tr>
</tbody>
</table>
Section II – FUNDING INITIATIVES AND AWARDS

The Centre’s history is rich in scientific reputation and credibility. As a result, several of CIM’s members were successful in obtaining major infrastructure grants in 2012, all of which are housed at CIM.

*NSERC Collaborative Research and Training Experience - Medical Imaging Analysis (CREATE-MIA)
The CREATE-MIA received $1.6M from NSERC and is headed by CIM-REPARTI member Kaleem Siddiqi. It also includes CIM-REPARTI member Tal Arbel, CIM associate members Bruce Pike and Louis Collins and REPARTI members Catherine Laporte (ETS) and Maxime Descoteaux (USherbrooke), and others in Quebec. More information on the CREATE-MIA can be found at http://aggie.cim.mcgill.ca.:8080/create-mia/

* NSERC Automotive Partnership Canada Initiative (APC)
The APC initiative received $5M from NSERC and is headed by CIM-REPARTI member Benoit Boulet. It also includes CIM-REPARTI members Jorge Angeles and Peter Caines, as well as other researchers at McGill. More information on the APC can be found at http://www.mcgill.ca/channels/news/mcgill-researchers-help-make-electric-cars-cheaper-225179

*NSERC Canadian Field Trial Network - (NCFRN)
The NCFRN received an award of $5M from NSERC and is headed by CIM-REPARTI member Gregory Dudek. It also includes CIM-REPARTI member Joelle Pineau and CIM member Inna Sharf, and others across Canada. For more information on the NCFRN, please go to: http://ncfrn.mcgill.ca/

AWARDS

Our sincere congratulations go out to all of our CIM student award recipients! The examples below represent only a very small sample of the total number of awards received by our students in 2012.

*CIM-REPARTI member Jeremy Cooperstock and his team in the Shared Reality Lab won the Mozilla/National Science Foundation Gold Prize "Ignite Challenge" (out of 305 submissions in the Brainstorming Round) for "Real-Time Emergency Response Observation and Supervision" Canadian Internet Registry Association .CA Impact Award (Applications category) for In-Situ Audio Services Project


*CIM-REPARTI PhD candidates Toufic Azar (ME-Jorge Angeles/Jozsef Kovaces) and Ahmad Haidar (ECE-Benoit Boulet) were each a recipient of a William and Rhea Seath Awards in Engineering Innovation in 2012. Both Toufic and Ahmad were awarded a stipend of $20K to be spent on the development of algorithms, fabrication costs and salaries for each of their projects.

Section II – PUBLICATIONS

PUBLICATIONS - Department of Electrical and Computer Engineering

ARBEL, Tal

Articles in refereed publications


Papers in Refereed Conference Proceedings


B. Oreshkin* and T. Arbel, ”Optimization over Random and Gradient Probabilistic Pixel Sampling for Fast, Robust Multi-Resolution Image Registration “, in the Fifth Workshop on Biomedical Image Registration (WBIR 2012), Vanderbilt University,Nashville, Tennessee, USA, July 2012. (oral presentation).


Presentation by D. De Nigris*, PhD student under my supervision, "Fast and Robust Registration based on Gradient Orientations: Case Study Matching Intra-operative Ultrasound to Pre-operative MRI in

BOULET, Benoit

Articles in refereed publications


Other refereed contributions


CAINES, Peter

Articles in refereed publications
Publications in Journals and Books


Conference Publications


A. C. Kizilkale and P.E. Caines, "Emergence of Coalitions in Mean Field Stochastic Systems", IEEE Conference on Decision and Control, Maui, HI, USA, December, 2012, pp. 5768 - 5773


A. C. Kizilkale and P.E. Caines, "Emergence of Coalitions in Mean Field Stochastic Systems", IEEE Conference on Decision and Control, Maui, HI, USA, December, 2012, pp. 5768 - 5773


CLARK, James

Articles in refereed publications


Other refereed contributions

Demirkus, M., Precup, D., Clark, J.J. and Arbel, T., "Soft Biometric Trait Classification from Real-world Face Videos Conditioned on Head Pose Estimation.", 2012 CVPR Workshop on Biometrics.


**COOPERSTOCK, Jeremy**

Articles in refereed publications


7. J. Blum*, M. Bouchard*, and J. R. Cooperstock. “Spatialized audio environmental awareness for blind users with a smartphone.” Mobile Networks and Applications


Other refereed contributions

Papers in refereed conference proceedings:


Book Chapters


FERRIE, Frank

Articles in refereed publications


Other refereed contributions


LEVINE, Martin

Articles in refereed publications


2. Jian Li, Martin D. Levine (Student thesis supervisor and primary contributor), Xiangjing An, Xin Xu and Hangen He, Visual Saliency Based on Scale-Space Analysis in the Frequency Domain, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2012 [in Press]

Conference Proceedings


MAHAJAN, Aditya

Articles in refereed publications


Other refereed contributions


MICHALSKA, Hannah

Articles in refereed publications


Other refereed contributions


PUBLICATIONS - Department of Mechanical Engineering

ANGELES, Jorge

Articles in refereed publications


Other refereed contributions


Invited presentations


Angeles, J., 2012, El Concepto de Complejidad Como Criterio de Diseño en Ingeniería Mecánica (The Concept of Complexity as a Design Criterion in Mechanical Engineering), Keynote Lecture at the XIX National Congress of Mechanical Engineering, sponsored by the Spanish Society of Mechanical Engineering, November 14-16, Castellón de la Plana, Spain.

CORTELEZZI, Luca

Articles in refereed publications


KOVECSES, Jozsef

Articles in refereed publications


Other refereed contributions


NAHON, Meyer

Articles in refereed publications


Other refereed contributions


Invited presentations


SHARF, Inna

Articles in refereed publications


Other refereed contributions


PUBLICATIONS- School of Computer Science

DUDEK, Gregory


KRY, Paul

Refereed Journals


-- (Stolpner, S., Kry, P. G., Siddiqi, K.), Medial Spheres for Shape Approximation, IEEE Transactions on Pattern Analysis and Machine Intelligence, v. 34, n. 6, pp. 1234-1240, 2012. DOI: 10.1109/TPAMI.2011.254

Refereed Conference Proceedings


-- (Aladdin, R., Kry, P. G.), Static Pose Reconstruction with an Instrumented Bouldering Wall, VRST '12 Proceedings of the 18th ACM symposium on Virtual reality software and technology, pp. 177-184, 2012. doi>10.1145/2407336.2407369


LANGER, Michael

REFEREED Journals


(Special issue: top five papers from the ACM Symposium on Applied Perception (SAP), Los Angeles, CA, Aug. 2012)

Other publications

"Qualitative shape from shading, specular highlights, and mirror reflections" (Abstract) Michael Langer, Arthur Faisman Vision Sciences Society (VSS), Annual Meeting, Naples Florida May 2012
"Qualitative shape from specular reflections" (Abstract)
Arthur Faisman, Michael Langer

PINEAU, Joelle

REFEREED Journals


51p. DOI 10.1007/s10458-012-9200-2


Publications in REFEREED Conference Proceedings


**SIDDIQI, Kaleem**

**Referred Journals**

P. Savadjiev, G. J. Strijkers, A. J. Bakermans, E. Piuze, S. W. Zucker & K. Siddiqi  

S. Stolpner, P. Kry & K. Siddiqi  
Medial Spheres for Shape Approximation.  
[PDF] © 2012 by IEEE

** REFEREED Conference Proceedings**

M. Bieth, K. Siddiqi, P. Gravel and A. J. Reader  
Towards Automated MR-independent Estimation of Neuroreceptor Binding Potential Parametric Maps for PET.  
All departments submit an annual report to the university that contains updated information on grants and publications. Please see links below for CIM members and associates.

**FACULTY OF SCIENCE**  
**School of Computer Science**  
http://www.cs.mcgill.ca/research/publications  
http://www.cs.mcgill.ca/about/reports  
**Full Members:**  
Gregory Dudek, Michael Langer, Paul Kry, Joelle Pineau, Kaleem Siddiqi  
**Associate Members:**  
Xue Liu, Prakash Panangaden, Doina Precup

**FACULTY OF MEDICINE**  
**Associate Members:**  
Dr. Renzo Cecere http://ct-surgery.mcgill.ca/faculty_rcecere.htm  
Dr. Louis Collins http://www.bic.mni.mcgill.ca/PeopleFaculty/CollinsDLouis  
Dr. Bruce Pike http://www.bic.mni.mcgill.ca/PeopleFaculty/PikeBruce

**FACULTY OF ENGINEERING**  
**Department of Electrical and Computer Engineering**  
http://www.mcgill.ca/ece/about/reports/  
**Full Members:**  
Tal Arbel, Benoit Boulet, Peter Caines, James Clark, Jeremy Cooperstock, Frank Ferrie, Martin Levine, Hannah Michalska, Aditya Mahajan  
**Associate Member:**  
Sam Musallam  
**Department of Mechanical Engineering**  
http://www.mcgill.ca/mecheng  
**Full Members:**  
Jorge Angeles, Luca Cortelezzi, Jozsef Kovecses, Meyer Nahon, Inna Sharf, Paul Zsombor-Murray  
**Associate Members:**  
Arun Misra, Rosaire Mongrain, James Richard Forbes