



Carleton
UNIVERSITY

Department of
Systems and Computer
Engineering

Biomedical Engineering Research at Carleton

Dr. Andy Adler

Canada Research Chair
Biomedical Engineering

Systems and Computer Engineering

Carleton University





Researcher: Yuu Ono

Systems and Computer Engineering



Research Areas:

- ◆ Sensors development and applications
- ◆ Biomedical monitoring, diagnosis, and characterization
- ◆ Ultrasonic imaging and acoustic microscopy
- ◆ Piezoelectric / Ultrasound sensors

Piezoelectric/Ultrasonic Sensors for Biomedical Applications

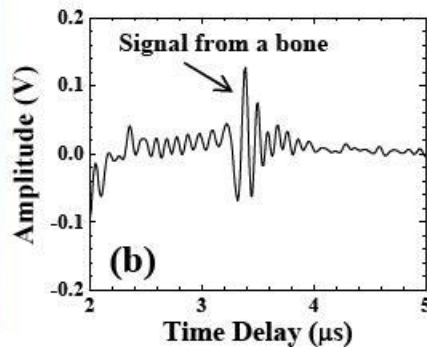
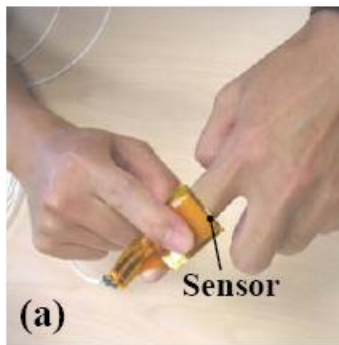
Health Condition Monitoring



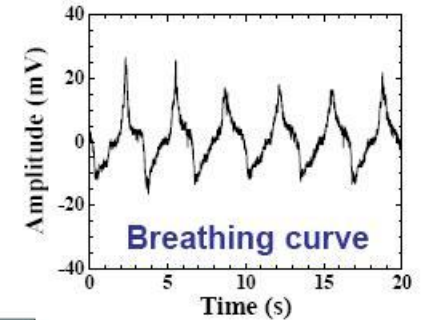
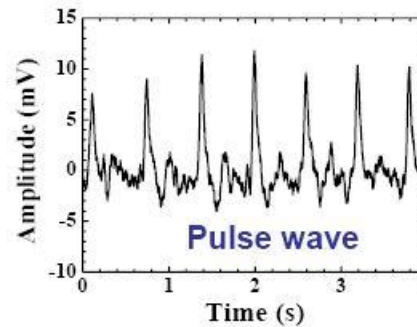
Flexible piezoelectric/ultrasonic film sensor



Medical Imaging & Diagnosis



Ultrasonic signals from bone



Researcher: Don Russell



*Mechanical and Aerospace
Engineering*

Research Areas:

- ◆ Design and Control of Advanced Prosthetic Arms
- ◆ Control and Dynamics of Artificial Hearts and Ventricular Assist Devices
- ◆ Biomechanics of Musculoskeletal Injury in Skilled Musicians
- ◆ Modelling of Interacting Dynamic Systems



Researcher: Peter Liu



*Systems and Computer Engineering
Canada Research Chair in Interactive
Network Computing and
Teleoperation*

Research Areas:

- ◆ Robotic Surgery
- ◆ Telemedicine
- ◆ Haptics

Robotic Surgery

- ◆ Surgical simulation and training
 - ◆ Haptic modelling
 - ◆ Tissue modelling
- ◆ Telesurgery
 - ◆ Stability under transmission time delays
 - ◆ Enhancement of haptic fidelity
 - ◆ Networking protocols and data transmission

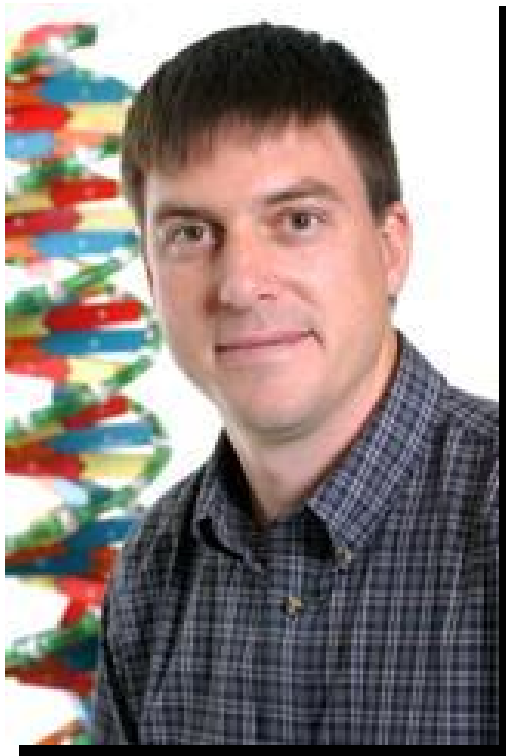
Surgery Simulator





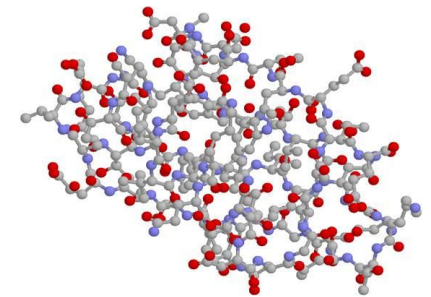
Researcher: James Green

Systems and Computer Engineering



Research Areas:

- ◆ Bioinformatics, toxicogenomics, proteomics, and prediction of protein structure & function
- ◆ Biomedical pattern classification
- ◆ Development of novel assistive technology and devices



Researcher: Rafik Goubran



*Systems and Computer Engineering
Acting Dean, Faculty of Engineering
and Design*

Research Areas:

- ◆ Technology Assisted Friendly Environment for the Third Age (TAFETA) Smart Apartment
- ◆ Heart and Lung Sound Analysis

Researcher: Thomas Garvey

School of Industrial Design

Research Areas:

- ◆ Acuity Adaptable Patient Room



Researcher: Monique Frize

Systems and Computer Engineering



Research Areas:

- ◆ Case-Based Reasoning Systems for Monitoring Infants
- ◆ Intelligent Systems - Neural Networks
- ◆ Thermal Imaging

Intelligent Systems for Monitoring Infants

Data analysis and modelling to estimate outcomes

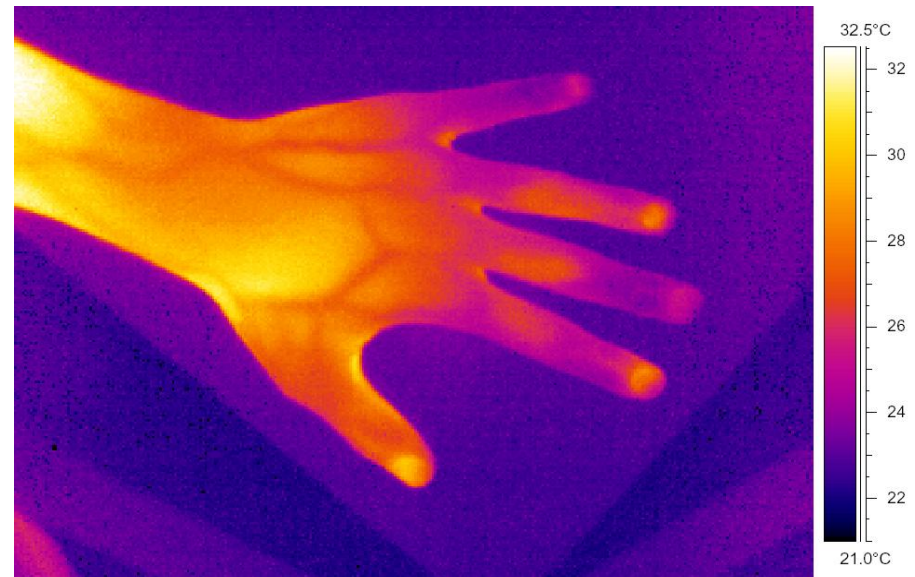
- ◆ Neonatal and adult intensive care units
- ◆ Perinatal and obstetric data
- ◆ Childhood injuries

Thermal imaging

Thermal medical image analysis applications

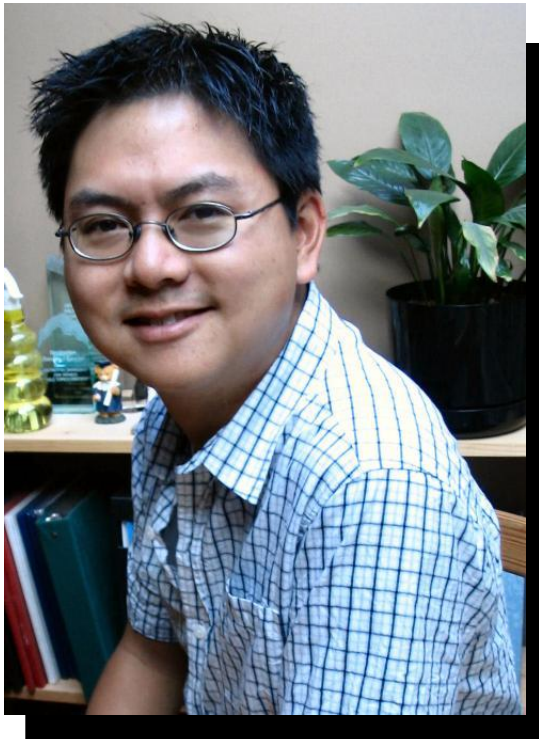
- ◆ Assessing pain in infants
- ◆ Neuromuscular injuries from piano-playing
- ◆ Breast cancer
- ◆ Rheumatoid arthritis (various types)

*Thermal
image
of hand of
pianist*



Researcher: Adrian Chan

Systems and Computer Engineering

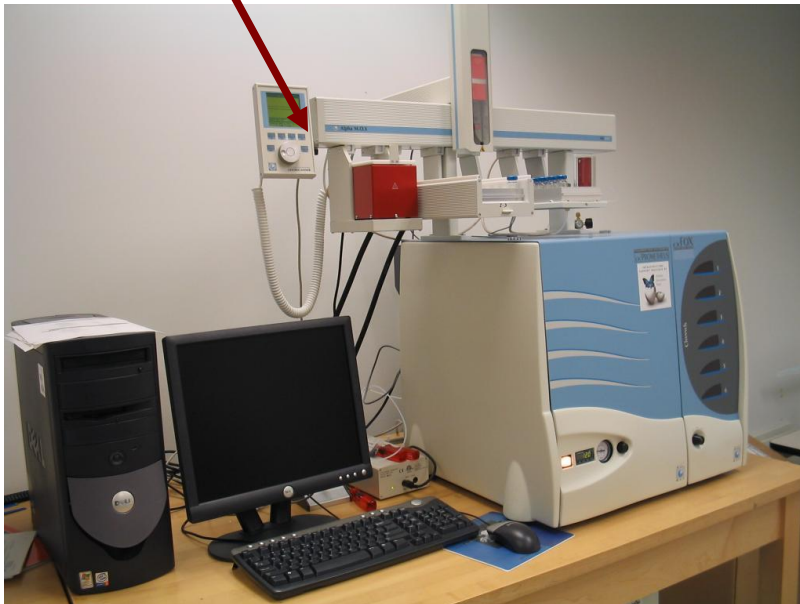


Research Areas:

- ◆ Biological signal processing
- ◆ Electronic nose
- ◆ Non-invasive devices
- ◆ Assistive devices

Researcher: Adrian Chan

Electronic Nose



Biological applications of electronic nose technology

- ◆ Detection and identification of bacteria
- ◆ Rapid screening for food-borne bacteria
- ◆ Provide timely and low-cost diagnosis of diseases
- ◆ Continuous monitoring (e.g. wound infections)

Researcher: Adrian Chan

Nose



Biological applications of electronic nose technology

- ◆ Detection and identification of bacteria
- ◆ Rapid screening for food-borne bacteria
- ◆ Provide timely and low-cost diagnosis of diseases
- ◆ Continuous monitoring (e.g. wound infections)

Researcher: Adrian Chan



Virtual Arm controlled
by muscle signals

Myoelectric control of upper arm prosthesis

- ◆ Enable continuous control that is reliable, natural, and intuitive
- ◆ Multifunctional control

Researcher: Mojtaba Ahmadi

Mechanical and Aerospace



- ◆ Robotic prosthetic limbs
- ◆ Machine and biological locomotion
- ◆ How robots can be used for artificial legs or walking aids



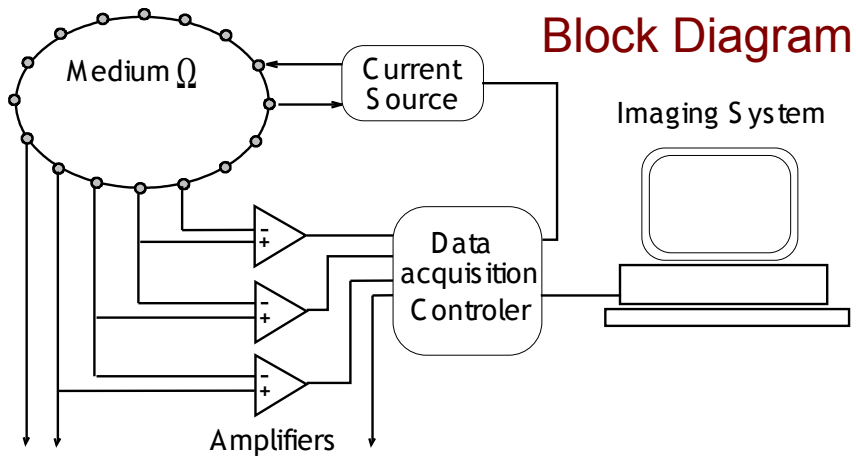
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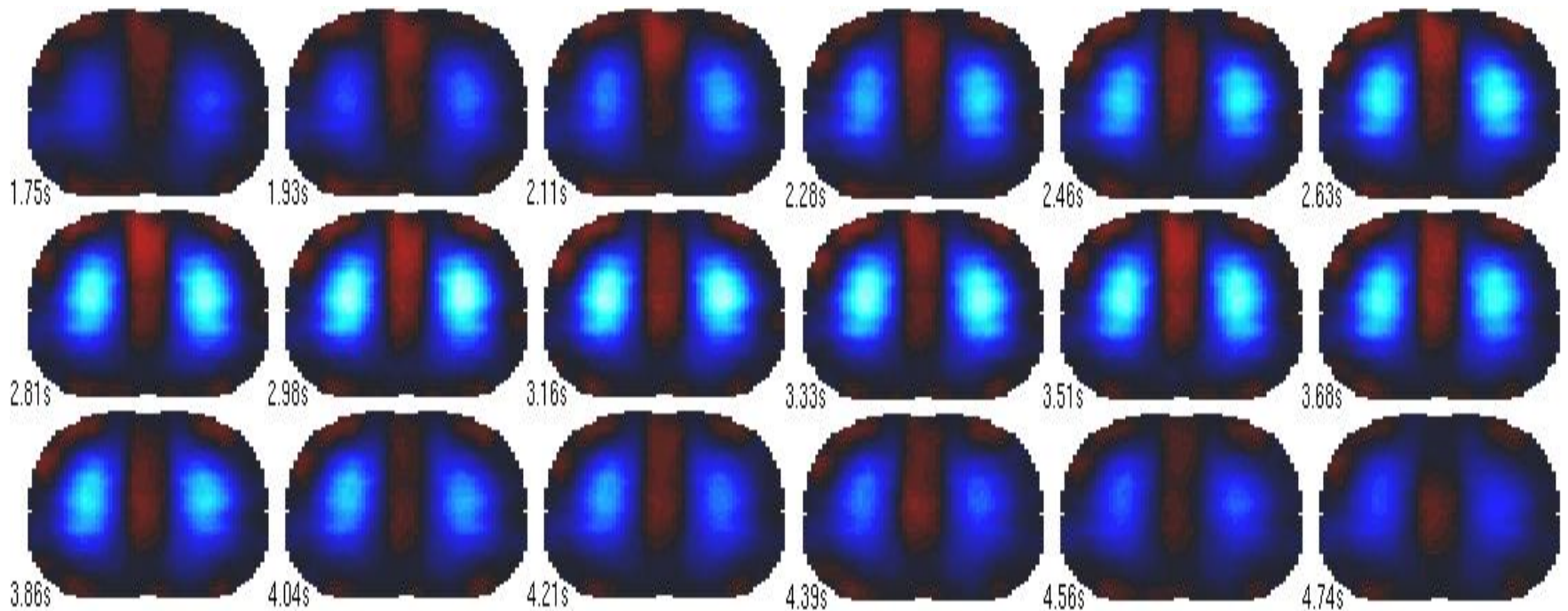


- ◆ Electrical Impedance Tomography
- ◆ Medical Imaging algorithms
- ◆ Lung function monitoring

Electrical Impedance Tomography

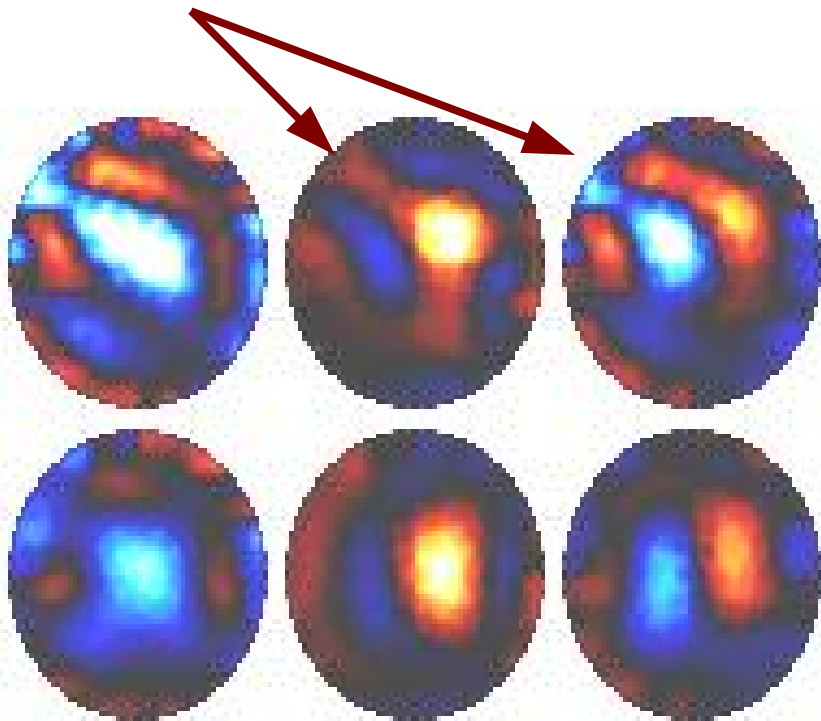


Images of Breathing

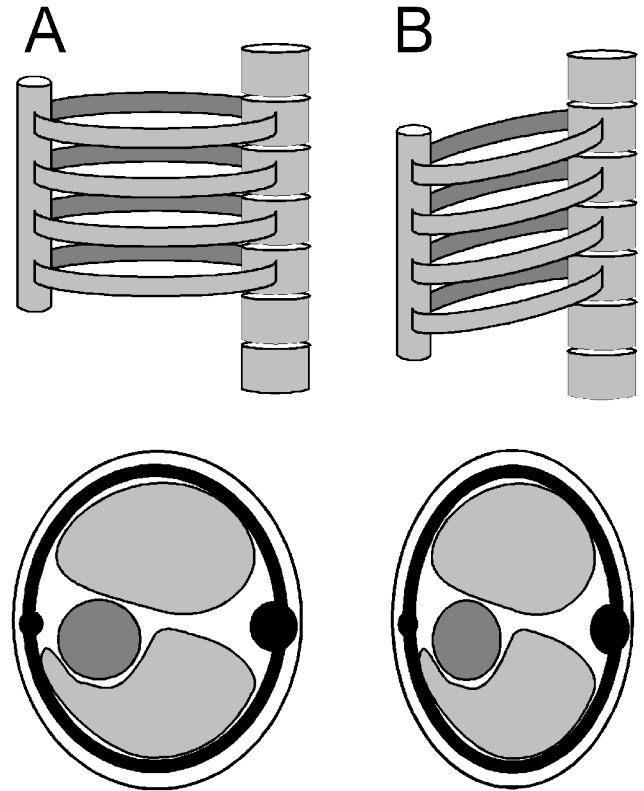


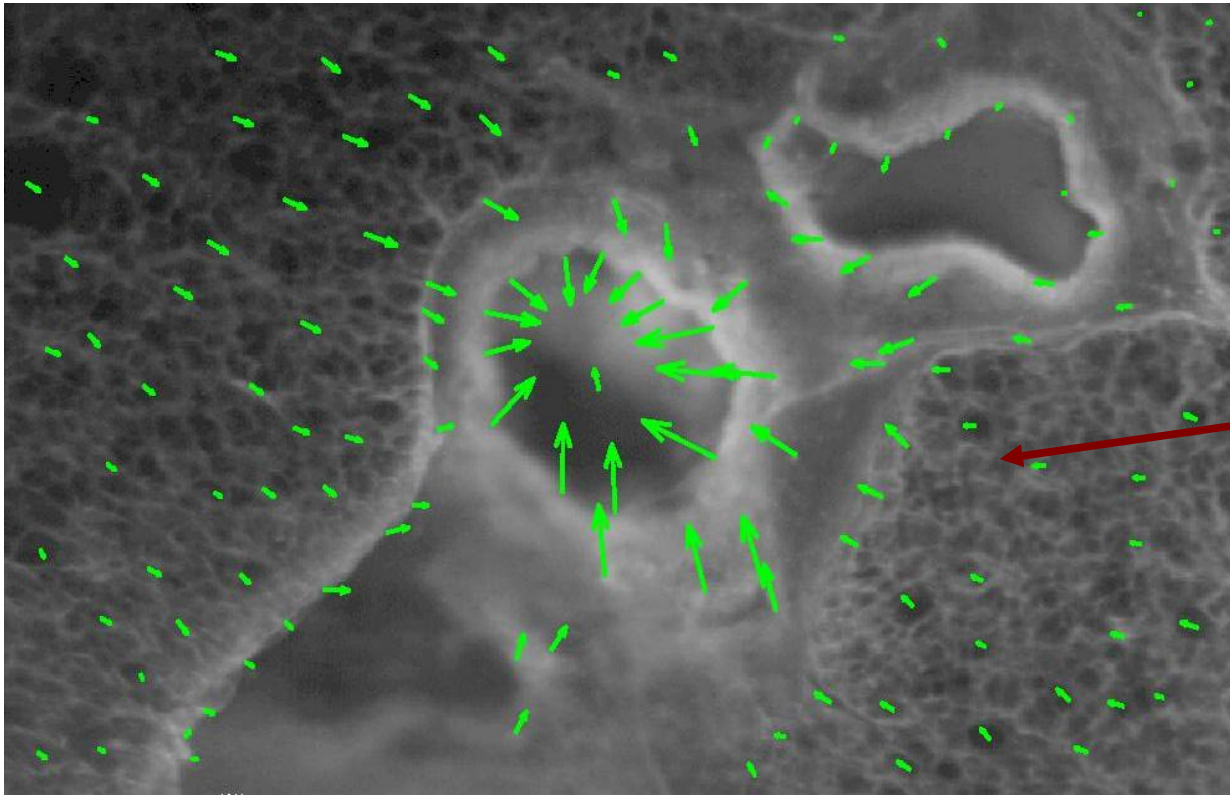
Detection and compensation for “bad” electrodes

“Bad”
Electrode



Compensated





Lung tissue movement in asthma model

Computational model

