

The Future of Engineering

Challenges and opportunities

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Conf of Eng and Tech for Suistanable Development

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Get source of this slides and see further references from <https://github.com/mxochicale/itds2020>.



Contents

1. Short-bio
2. Challenges and Opportunities in Engineering
 - 2.1. Engineering as Multidisciplinary Field
 - 2.2. Mechatronics and Robotics Engineering
 - 2.3. Open-source projects
3. The Future Engineering
4. My lines of research

Short-bio

My Journey in Engineering and Science

- (1996-1999) High School in Electronics
- (1999-2004) BSc in Electronics
- (2004-2006) MSc in Signal Processing
- (2006-2012) Teaching Associate in Mechatronics
- (2013-2014) Research Assistant in Robotics at INAOE
- (2014-2019) PhD student in Human-Robot Interaction at Uni of Bham
- (2019-present) Research Associate in Ultrasound-Guidance Intervention at KCL



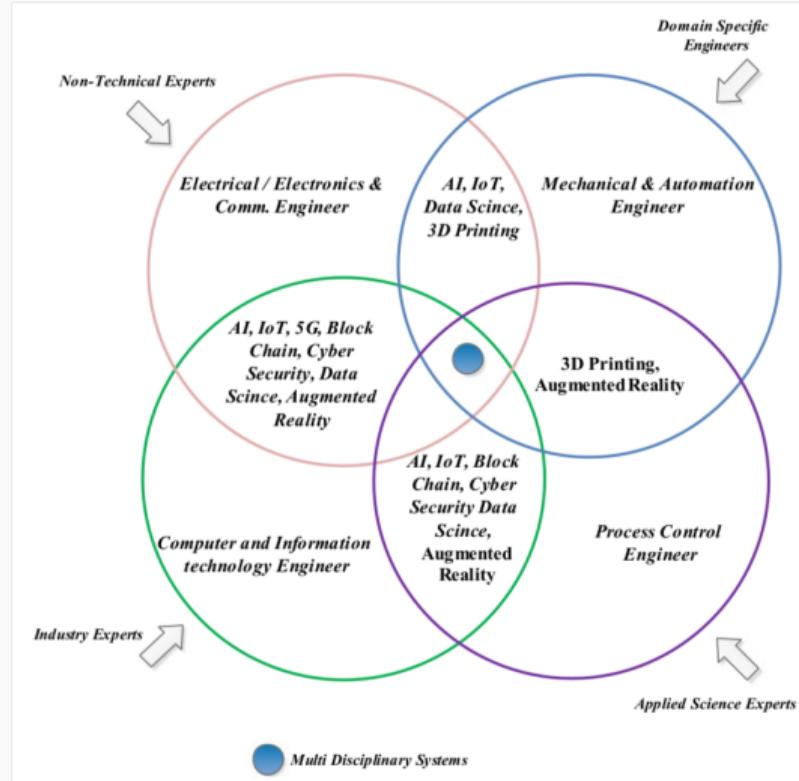
Challenges and Opportunities in Engineering

Challenges in Engineering

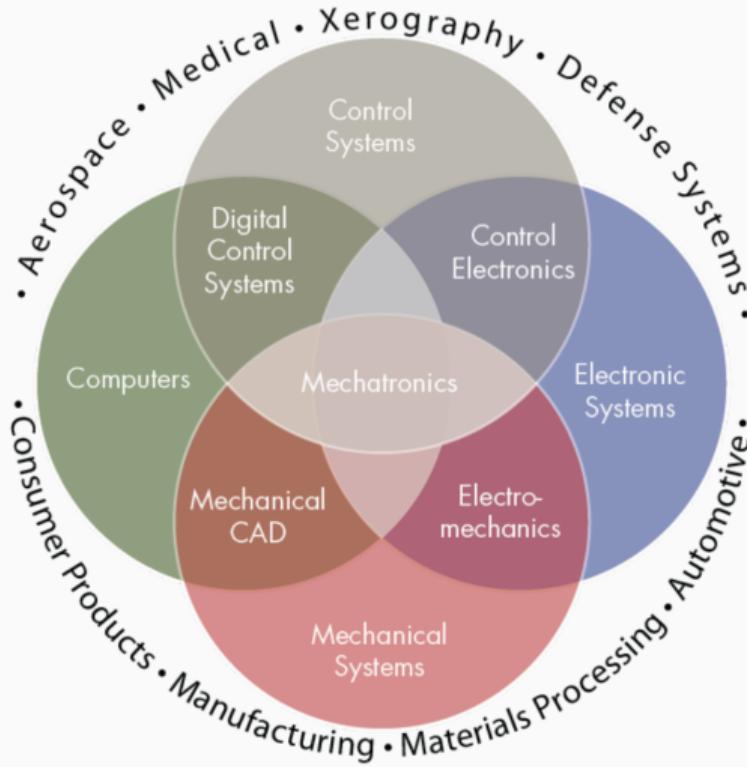
- Advance Personalised learning
- Make Solar Energy Economical
- Enhance Virtual Reality
- Reverse-engineer the brain
- Engineer better medicines
- Advance Health Informatics
- Restore and improve urban infrastructure
- Secure cyberspace
- Provide access to clean water
- Provide energy from fusion
- Develop Carbon Sequestration Methods
- Engineer the tools for science discovery



Engineering as Multidisciplinary Field



Robotics Engineering



Open-source projects

Open Source low-cost ventilator



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Great progress of #OpenSource low-cost #Ventilator(s) which will be also facing regulatory approvals of their design! If you can, contribute to them! 🙏🌍🌐

Gitlab: gitlab.com/TrevorSmale/OS...
Github: [github.com/jcl5m1/ventila...
oxvent.org](https://github.com/jcl5m1/ventila...)



7:49 pm · 20 Mar 2020 · Twitter Web App

OpenSource Rover



Miguel Xochicale
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Ever wanted to build your own #opensource rover? Well now you can! courtesy of @NASAJPL

WEBSITE: opensourcerover.jpl.nasa.gov
GITHUB: github.com/nasa-jpl/open...

For those who want to get involved in mechanical engineering, software, electronics, or robotics.



12:48 pm · 25 Jul 2020 · Twitter Web App

OpenSource Microscope



Miguel Xochicale
 @_mxochicale

💡 Microscopy for everyone courtesy of @OpenFlexure openflexure.org/projects/micro...

OpenFlexure Microscope



Build a Microscope

A guide to printing and assembling an OpenFlexure Microscope



Install the Software

Prepare your Raspberry Pi by installing Raspbian-OpenFlexure



Use your Microscope

Download and install software to control your microscope

The Future Engineering

Disruptive technologies



Future of Engineering in Robotics and AI

Blockchain and Cloud Robotics



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"with the integration of #Blockchain, the #ROS interface for physical systems, Cloud #Robotics, and #IoRT, autonomous robotic agents could find a starting point for the technology needed in a robot economy" by M Arduengo, L Sentis

[arxiv.org/abs/1812.01755 \(v4\)](https://arxiv.org/abs/1812.01755)



Fig. 1 Robots are rapidly developing capabilities that could one day allow them to participate as autonomous agents in economic activities with the potential to change the current socio-economic scenario. Some interesting examples of such activities could eventually include entering into agreements with human users, the purchase of goods and services, and the participation in highly unstructured production processes.

9:02 pm · 20 Aug 2020 · Twitter Web App

AI in Surgery



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Artificial Intelligence in Surgery

Zhou et al. Dec 2019 arxiv.org/abs/2001.00627
#AI #MedicalRobotics

"Recent successful and influential applications of AI in surgery are reviewed from pre-operative planning and intra-operative guidance to the integration of surgical robots"



Figure 1: An overview of popular AI techniques, challenges, and subareas of AI used in pre-operative planning, intra-operative guidance, and subareas of AI used in pre-operative planning, intra-operative guidance, and surgical robotics.

8:10 am · 17 Jul 2020 · Twitter Web App

6G: communicating with the brain



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Neurosciences and 6G: Lessons from and Needs of Communicative Brains

Moioli, @PHJNardelli et al. Apr 2020
[arxiv: arxiv.org/abs/2004.01834](https://arxiv.org/abs/2004.01834)

citing [100] M. Mahmood et al. 2019 in
@NatMachIntell
nature.com/articles/s4225...

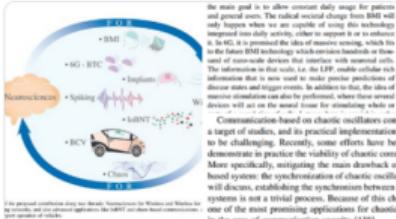


Figure 2: 6G technologies for medical applications including perception, localization & image processing, sensing, modeling & control, and human-robot interaction.

© The proposed conditions using two-domain (Neuroscience for Medical and Medical for Neuroscience) and one operator like 6GNT are also hard conditions.

Communication-based on chaotic oscillators could be a target of studies, and its practical implementation is to be challenging. Recently, some efforts have been made to mitigate the main drawback of chaotic oscillators. More specifically, mitigating the main drawback of these systems, the synchronization of chaotic oscillators will succeed, establishing the synchronization between these systems is not a trivial process. Because of this one of the most promising applications for chaotic oscillators in the area of communication security [138].

[@MARINA_5 | Edge AI @m_s304 · 8 Oct 2019](https://twitter.com/MARINA_5)

超薄型のフレキシブルな皮膚状の電極が開発され、障害のある方でもワイヤレスにセンサなどを操作できるようになったらしい。

深層学習でEEG信号(脳波)を分析しているとのこと。キャップを被り電極を装着せざつも皮膚に直接接する、電脳化が近づいてる....!

news.nicovideo.jp/watch/nws962550

Show this thread

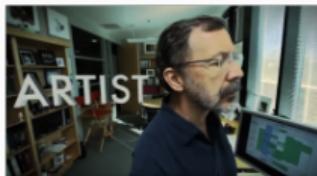
10:05 pm · 9 Jul 2020 · Twitter Web App

Few engineering skills

Explorer



Artist



Inventor



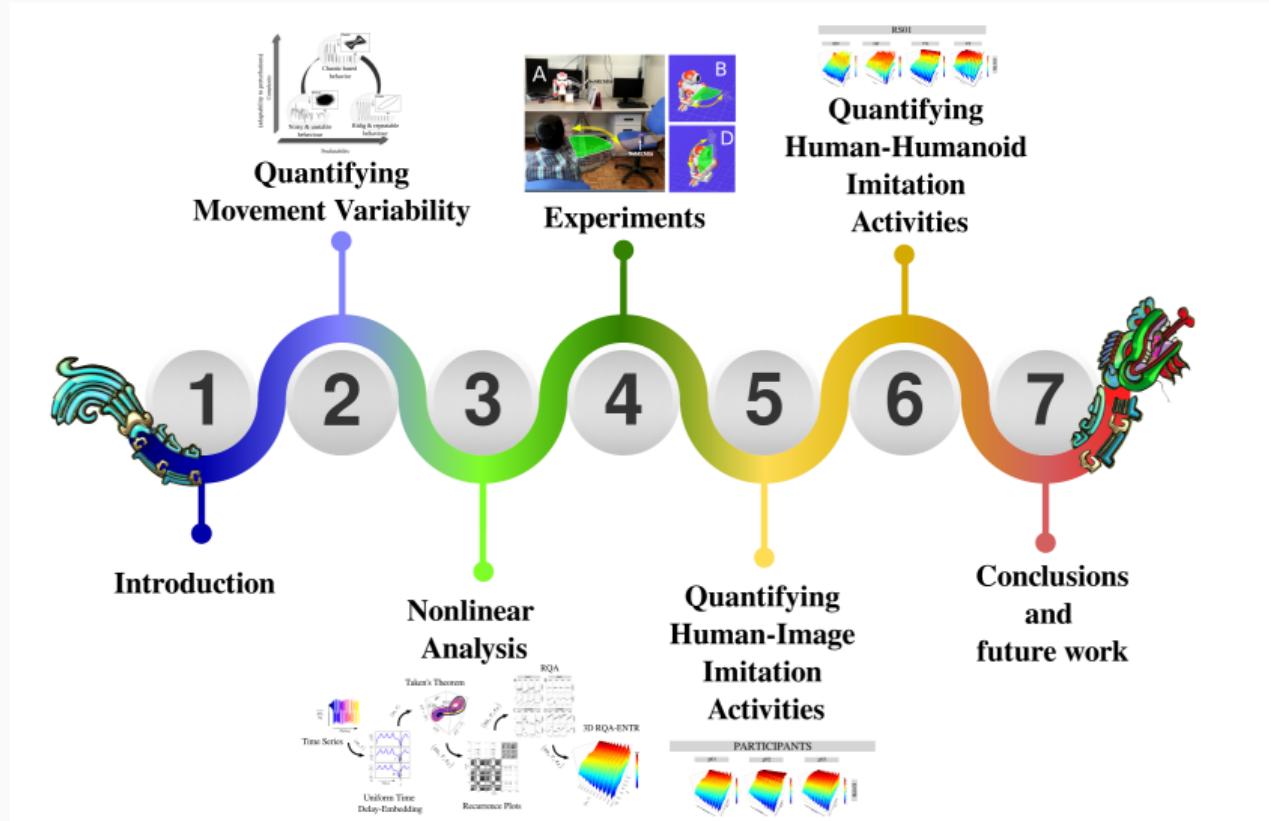
Game Changer



Rocket Launcher

My lines of research

Movement Variability in HRI using nonlinear dynamics

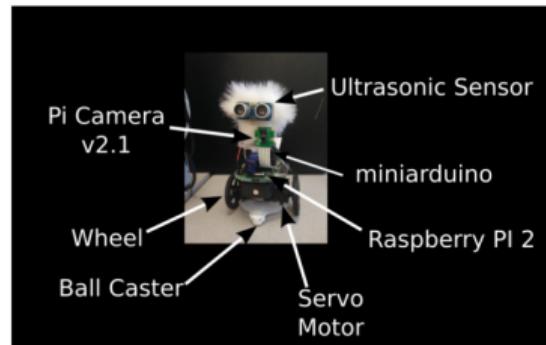


Artificial Intelligence and Robotics for Children

Prototype



Open Source Educative Robots



Free AIR for Children



Open-corTeX: ci framework for open scientific communication

- Tools such as CI and containers can improve reproducibility
- The adoption of open-CorTeX might lead to scientific outcomes that are aligned to the principles of reproducibility, inclusiveness, transparency, reusability and open accessibility.

open-corTeX: A continuous integration framework for open scientific communication

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Introduction

Full replication of scientific communication entails the release of code and data alongside with its documentation [1, 2, 3]. However, there are various challenges, in the current system of open scientific communication, such as the evaluation of scientific work, speed in the research dissemination process, respect for the freedom of science and research, dissemination and accessibility, digital availability of scientific publications, reproducibility and avoidance of misuse and research misconduct [2]. That being said, the use of continuous integration tools [4] and containers [3] is a starting point to tackle few of the previous challenges.

open-corTeX

open-corTeX is a proof-of-concept framework for open scientific communication and it is based on continuous integration (CI) of LaTeX documents by Luger and Foruman-Mackay 2019 [4] and GitHub actions running docker images of full TeXLive, a.k.a containers, by Xu 2020 [5]. Therefore, the open-corTeX framework involves two main steps: (a) the setting up of the yaml file for the GitHub action and (b) GitHub workflow. For the latter, one needs raises an issue, creates a branch, commits and pushes the changes for review and merges to master to then generate a full reproducible PDF document [6].



References

- [1] Pring Roger D. Reproducible Research in Computational Science. *In: Science* 354:eabb6000 (2016)
- [2] Bozzo Christian and Foruman-Mackay M. How Open Access in Space Science: The Park Ultraviolet Imaging Experiment. *Open Access Space Sci. J.* 2019, Vol. 1(1), Article 10.1111/1541-4529.12000
- [3] Koenig Philipp. Containerization for PDF-Output. *Big Data* 2018, Art. 102201 (Article 102201)
- [4] Luger Roger and Foruman-Mackay Daniel. Continuous-integrated OpenScience Reproducible. <https://github.com/mxochicale/openCorTeX>
- [5] Xu Chuan. Use Docker to compile LaTeX documents. May 2020. <https://github.com/ctxu/ctxu-latex-action>
- [6] Rodriguez Ignacio. openCorTeX: A framework for open-access continuous integration for LaTeX documents. GitHub repository. Sept. 2020. <https://github.com/mxochicale/openCorTeX>

Results

PDF-document outputs for article, thesis, CV, poster and slides with the use of openCorTeX [6].

Article Thesis



CV - Poster



Slides



Takeaways

- Tools such as CI and containers can improve reproducibility because of their portability and lightweight to produce the same output without regard to the operational systems.
- The adoption of open-corTeX might lead to scientific outcomes that are aligned to the principles of reproducibility, inclusiveness, transparency, reusability and open accessibility.

Thanks
Questions?