Research Reproducibility in Control and Systems Engineering

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Three questions about reproducible research:

- Within systems engineering, what is the level of awareness, interest, concern, and involvement in reproducibility and replicability (R&R) of research results?

- Are there specific areas within systems engineering that are more likely to have issues with reproducing scientific results?

- What reproducibility challenges does systems engineering face with cross disciplinary research?
Systems Engineering and Reproducible Research

A text for today’s briefing:

http://www.ieee.org/researchreproducibility

Joint work with:

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Research Products — Past and Present

- Publications
- Students
- Products

- Un-archived material
- New lines of R&D
- Infrastructure enhancements
- Proprietary use of IP

- Artifacts
Research Products — Past and Present
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• Research reproducibility is infrequently discussed in systems and control.

• “It’s more relevant in the social sciences than in Engineering.” – A former NSF Assistant Director, 2015.

• Historically, most areas of systems and control have not been involved with data, and although research has had significant software components, it has not been a tradition to publish code.

• There may be change in the air.
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• A growing body of research in robotics deals with exploration and data acquisition.

• Network science has come into its own and is increasingly focused on data

• New journals have been launched:
  o IEEE Transactions on Network Science and Engineering (2014)
  o IEEE Transactions on Control of Network Systems (2014)
  o IEEE Transactions on Signal and Information Processing Over Networks (2015).
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- Smart grid and advanced building automation technologies are increasingly data intensive.

- The increasing use of standard software libraries (e.g. ROS and OpenCV) provide encouragement for researchers to share code.

- The increasing sharing of code using GitHub and other collaboration sites reinforces the tendency to view software as a research product of equal standing to peer reviewed publications.
What is Code Ocean

An online code execution platform that integrates with any scholarly platform.

https://codeocean.com/

Feb. 2017, IEEE and Code Ocean launch joint effort to link journal publications with code

22 IEEE journals in the beta test
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Published Compute Capsule distribution

- Pre-publication
- Post-publication
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http://ieeexplore.ieee.org/document/8063416/algorithms

This article contains code made available via IEEE's partnership with Code Ocean, a cloud service that allows users to view, run, modify, and download code from IEEE Xplore articles. Click the code name below to access it on the Code Ocean website.

Name: 3D convolutional Neural Networks for Audio-Visual Recognition

Programming Language: Python
Challenges associated with viewing code, data, and even hardware as primary research products:

• Need to change an established culture to accept versioning.

• Need to develop scalable approaches to peer review of non-article research artifacts.

• Probably need new systems of badging along the lines being developed by the ACM.

• Code, data, and the associated research record itself need badges.

• Need to understand the boundary between legitimate reuse and plagiarism.
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Challenges associated with cross disciplinary research:

Data

15 TB

250 MB

Myotis velifer
Thank you