Welcome to the **Workshop on Environment-Driven Requirements Engineering** (EnviRE'21), Held Virtually, September 21, 2021 (8:00am-11:30am, EST)

Basic info

The workshop site is at https://homepages.uc.edu/~niunn/EnviRE/EnviRE2021.html

The Zoom link to the workshop is https://ucincinnati.zoom.us/j/95460654721

Participant info

Please feel free to share your name, title, affiliation, and email to all the workshop participants. This will allow us to build a community (e.g., inviting people to serve on the program committee in future workshops). Thanks!

- Nan Niu, Associate Professor, University of Cincinnati, USA, nan.niu@uc.edu
- Eunsuk Kang, Assistant Professor, Carnegie Mellon University, USA, eunsukk@andrew.cmu.edu
- Yijun Yu, Senior Lecturer, The Open University, UK, y.yu@open.ac.uk
- Zhi Li, Professor of Software Engineering, Guangxi Normal University, P.R.China, zhili@gxnu.edu.cn
- Shaukat Ali, Simula Research Laboratory, Norway, shauka@simula.no

(17 participants: 8:30am; 16 participants: 9:50am; 17 participants: 10:30am; 14 participants: 11:20am; 15 participants: 11:30am;

Keynote by Shaukat@Simula

CPSs are the connected embedded systems **integrating** cyber-technologies, software, and physical components **interacting** with each other via information and physical interfaces.

All the CPSs interact with **environment**: people, world, vehicles, sensors (climate)

Cisco, Norway; Oil & Gas, Norway; UAV; Maritime, Norway; Geo Sports, Sweden; Bombardier, Sweden; Elevator (Spain); Rovers… (examples of CPS)

Req.s Optimization

Find the use cases (scenarios) for analyst to review

Search-based uncertainty-aware req.s prioritization

Fitness function (probability of overrun if req.s are prioritized differently)

NSAG-II can prioritize req.s very quickly

Req.s learning

Emerging behavior can only be learned at runtime (configuring different Cisco products, each of which has different ways to configure a particular feature [e.g., product1 -> protocol: AIM, SIP, IRC, product2 -> shareScreen: false, true, product3 -> callRate: 50, …, 6000])

Req.s evolution

Uncertainty can exist in environment, in software (e.g., ML systems), in hardware, in information network

Q&As

Scalability on unknown/uncertain parameters (too many things can come from the environment); restricted by a (small) number of parameters (limited by the simulator)

Reinforcement learning

Exampers: software-in-the-loop (where we can control the environment in the simulator) elevators; rovers

RE for digital twins: What's special? Environment modeling & reasoning over the environment model; making the environment MORE REALISTIC (Jackson: faithful) within the digital twins

Is environment all manifested into/by the SIMULATORS? (physics, mathematics) Find better ways to specify REQUIREMENTS

Seeded discussion points

The work's contributions to EnviRE

Env-based req.s modeling (<-- add constraints) + clock-based modeling & reasoning to detect inconsistency

Making phenomena and reference explicit (extended) in PFs

Abstraction VERSUS software complexity (essence according to Brooks)

Specifying autonomous driving scenarios

Perburbations to ML model (<-- underlying cause to environmental deviations)

Software robustness VERSUS Env.al robustness

Answer: Neither software/machine, nor env.; more about the "entailment"

What should/would/could happen to EnviRE in the near future

Coping with environmental deviations (remaining robust against \Delta in E)

Robustness of ML has been focused on "model", RE can help connecting to the env (env deviations)

"Unknown unknowns" (devisions that are NOT expected)

Specifying "env.al deviations" [where (in which model/models); how?]

Modeling env.al uncertainty; personalized services in uncertain env; domain knowledge of uncertainty

Participant notes

(feel free to leave questions, comments, thoughts, etc. here)

If MetaVerse or Augmented Reality (AR) becomes ubiquitous, what opportunities/challenges do such technology bring to EnviRE?

Some open source case studies used at Simula

- Autonomous cars (Environment can be simulated)
    - Carla: https://carla.org/
    - LGSVL: https://github.com/lgsvl/simulator/releases/tag/2021.2.2
- Ardu (We used UAV, where hardware and environment was emulated)
    - https://ardupilot.org/