ASME
IDETC-CIE 2025

INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES & COMPUTERS AND INFORMATION IN ENGINEERING CONFERENCE

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Monitoring and Modeling LPBF Powder Spreading Conditions

- Problem formulation
- Literature review and exploration of ideas
- Development and design of the idea
- Scientific soundness of the approach
- Creativity of the approach
- Readiness of the idea and approach

Christopher Waight

Santa Clara University

PhD Candidate in Robotics

TASK 1: Can we mask the Defects

Task 2: Can we create synthetic images

Initial Data Exploration shows us:

All images are greyscale.
All have the same size and basic orientation.
Only two types of errors.
Relatively small images. 139 * 250 * 3 pixels (w * l * c)
Class Imbalance (17% pixels are streaks, less than 1% of pixels are spots.
Labels look imperfect and hand drawn.
We have some unlabeled data we can use.
Data comes in triples (or in 5s)
Not much data

TASK 1: Can we mask the Defects
Task 2: Can we create synthetic images

Task 1 is a masking task - literature suggests using U-net

All images are greyscale - Only use the Red Channel **
All have the same size and basic orientation. - Inspired data augmentation
Only two types of errors - 2 channel output.
Relatively small images. 139 * 250 * 3 pixels (w * l * c) - Can be run locally ***
Class Imbalance - Loss function needs to reflect this.
Unlabeled data - Unsupervised learning
Bad Labels - Can use morphological filters to smooth out
Small Dataset - Data augmentation

Synthetic images

Literature says VAE or GAN
VAE is easy to implement.
GAN is more realistic but can suffer from model ****

TASK 1: Can we mask the Defects

Develop Morpho filters
Develop Augmentation - (small rotations, and flips only)
Develop U-net - Base 48 (Ran on a A100)
Morpho and Augmentation to both training and target data
Training time implementation - infinite training set
After model is trained, scan is done to select confidence.
Morpho the output

Synthetic images
Literature says VAE or GAN
VAE is easy to implement.
GAN is more realistic but can suffer from model ****

Photos not available

TASK 2: DCGAN

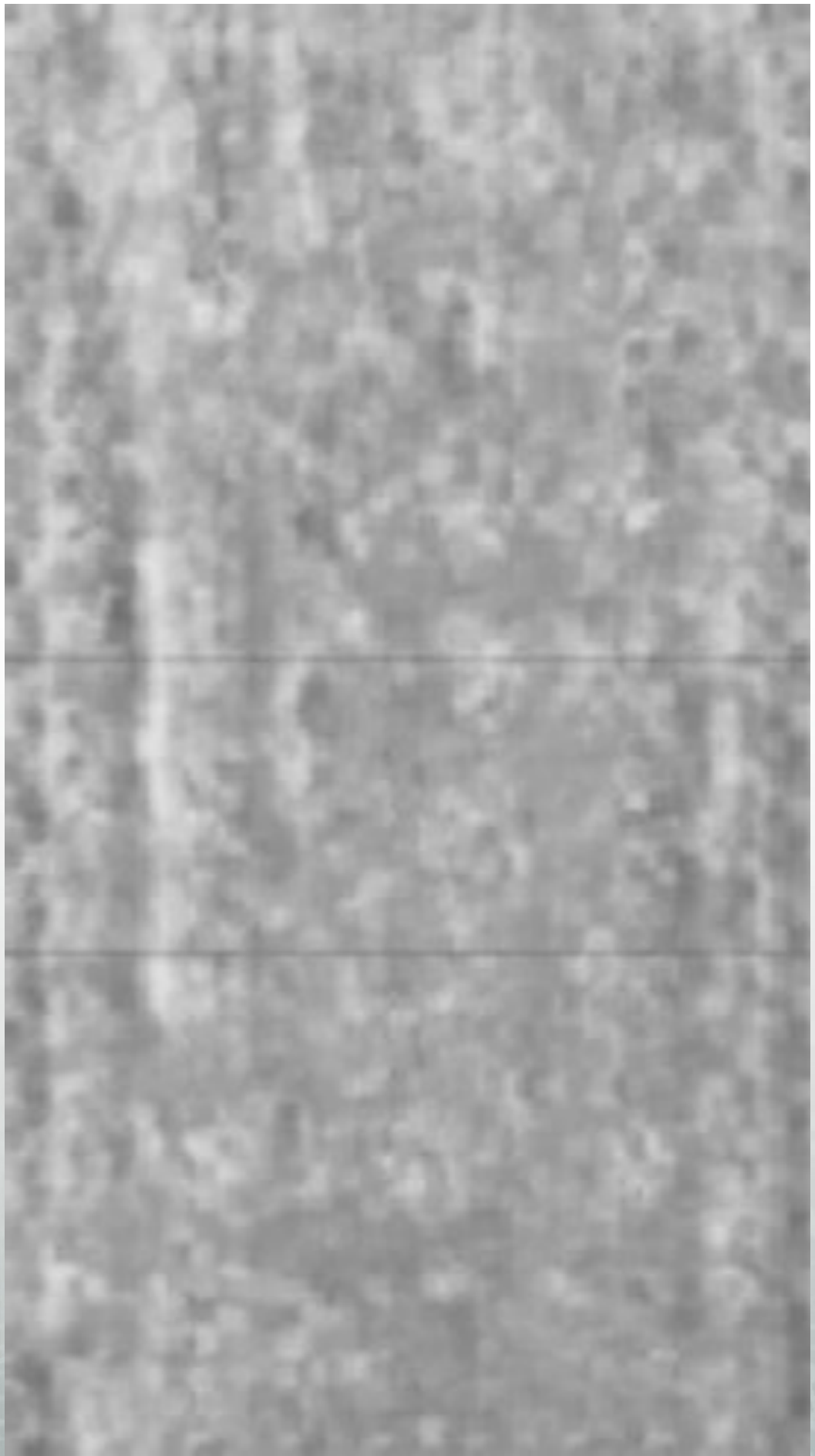
Create 5 Channels (1R from each lighting condition + masks)

Create DC - GAN

Generate 100 images

Split output layers into lighting categories

Duplicate layers 3 times for RGB channels



Hackathon Summary

- Three technical problems:
  - **Problem 1 - Monitoring and Modeling LPBF Powder Spreading Conditions** (Zhuo Yang and Yan Lu from NIST)
  - **Problem 2 - Design Documentation Decoded: Improving AI's Understanding of Engineering Documents** (Annie Doris from Decode Lab at MIT and Daniele Grandi from Autodesk)
  - **Problem 3 - Accelerating Design Exploration and Optimization with Surrogate Physics Models** (Matthew Mueller and Ajay Prasad from nTop)
- Awards for each problem:
  - 1st place: $1,400,
  - 2nd place: $700,
  - 3rd place: $350.
- **58+** participants; **33+** different institutions; **6+** different countries.

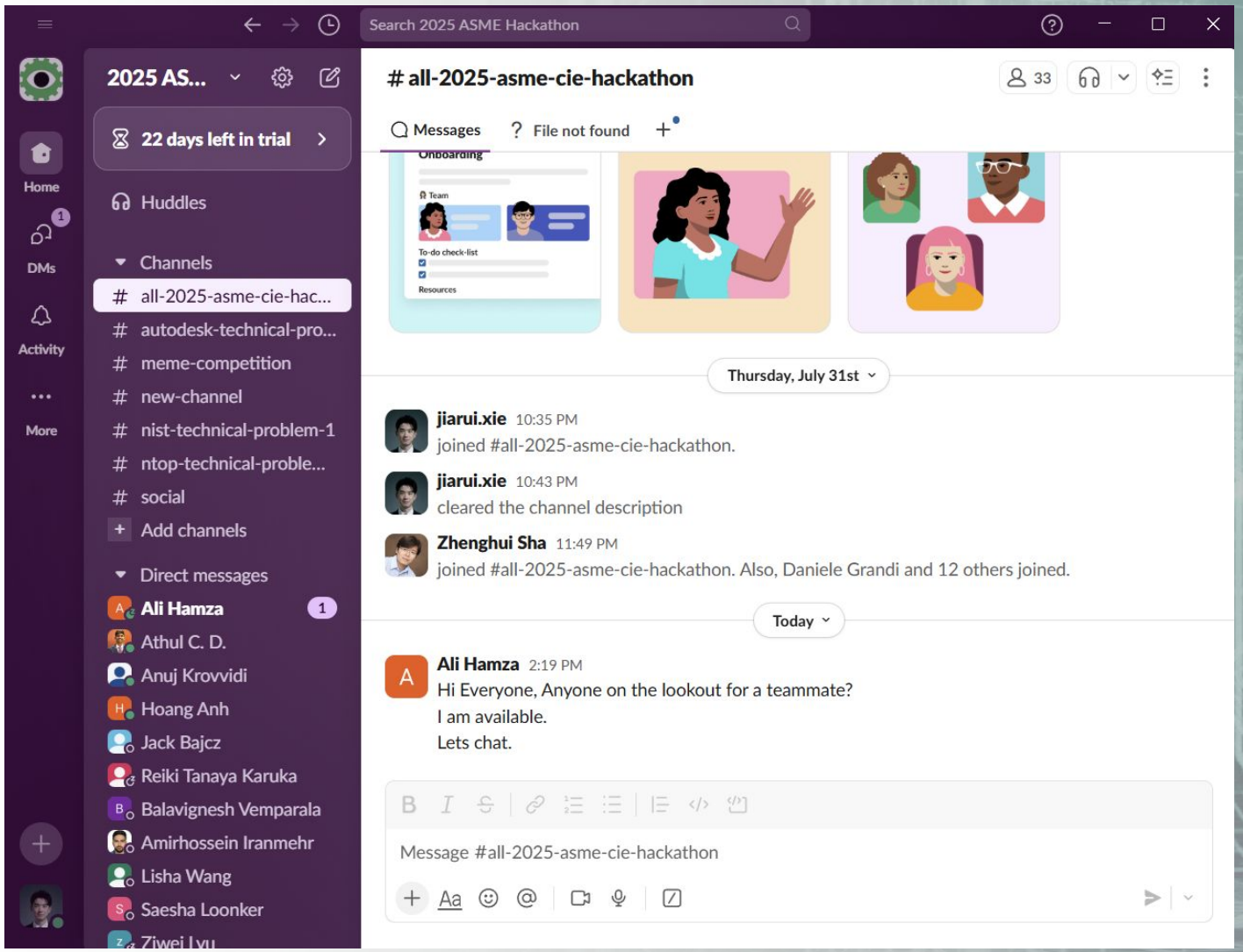
Agenda

First day (Sunday, 8/10/2025)	
Time (**EDT**)	Agenda
11:00 – 11:30	Hackathon Kick-off (Meeting link: **ASME 2025 Hackathon Kick-off**)
11:30 – 11:50	NIST: Technical Problem #1 Presentation
11:50 – 12:10	Autodesk: Technical Problem #2 Presentation
12:10 – 12:30	nTop: Technical Problem #3 Presentation
12:30 – 13:00	Q&A
13:00 – 14:00	Participation socialization (MS Teams/Slack) (Meeting link: **ASME 2025 Participation Socialization**) Slack Channel: **Join Slack Workspace**
14:00 (8/10/2025) – 18:00 (8/12/2025)	Team formation
Third day (Tuesday, 8/12/2025)	
Time (**EDT**)	Agenda
18:00 (8/12/2025)	Deadline to fill out the team formation form
Final day (Sunday, 8/17/2025)	
Time (**PDT**)	Agenda
6:00	Deadline for result submission
8:00 - 10:00	Check-in & working cycle (Meeting link: **ASME 2025 Final Day Check-in and Kick-off**)
9:30 - 10:00	Coffee break
10:00	Deadline for presentation submission
10:00 - 10:15	Final day kick-off: Announce presentation schedule. Problems and judging criteria recap
10:30 - 11:30	Presentation session
11:30 - 12:30	Lunch
13:00 - 15:00	Presentation session
15:00 - 15:15	Coffee break
15:15 - 16:15	Presentation session
16:15 - 17:30	Judge discussion
17:30 - 18:30	Awards & closing ceremony

Communication Channels

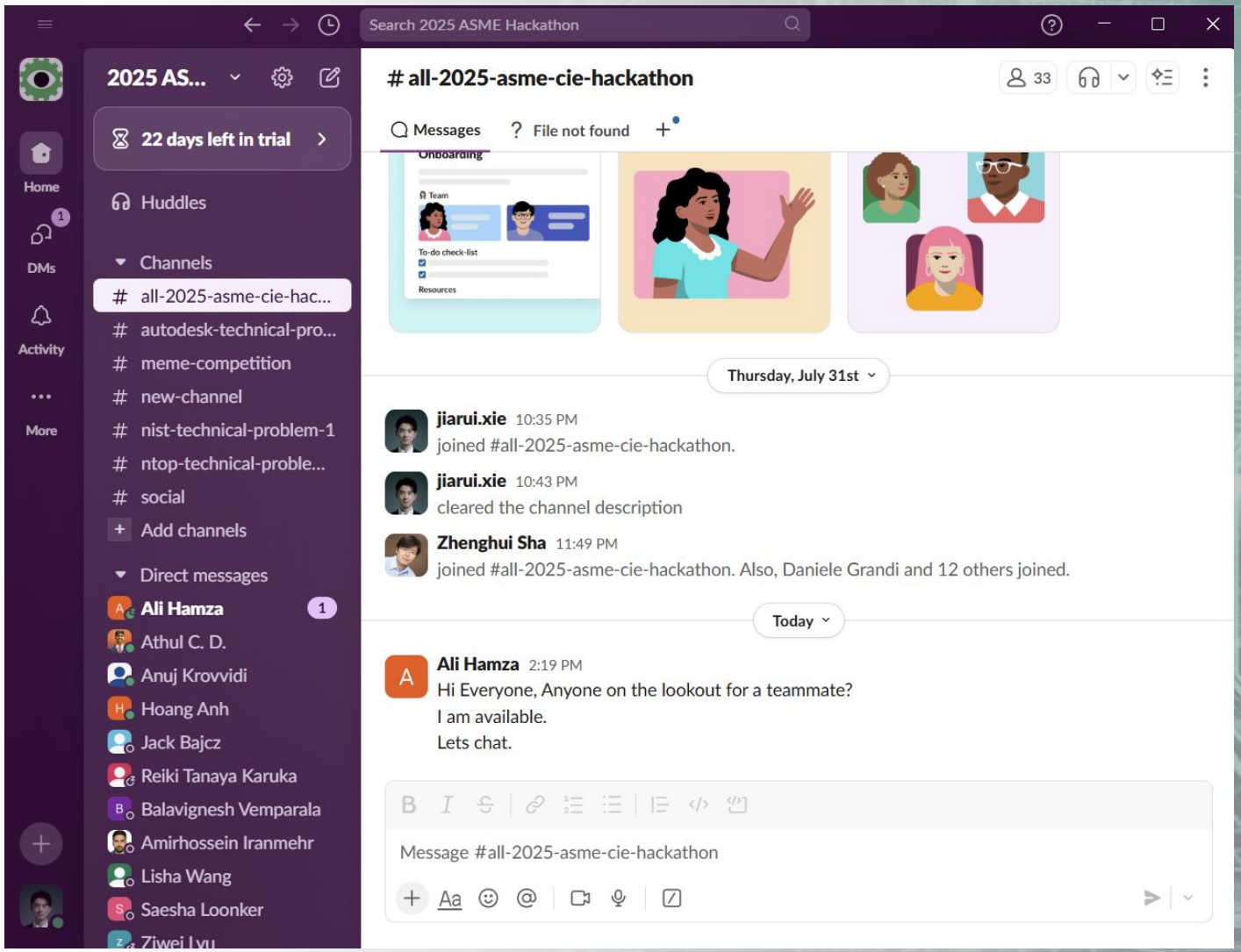
Announcements will be made through **Slack Workspace** and **emails :**

- Slack Channel: [Join Slack Workspace]
  - Major communication method
  - Different channels for different problems
  - Find teammates
  - MEME challenge
- Email: idetccie.seikm@gmail.com
  - You can also email your questions to the organizing committee.
  - Notifications might go to your spam.



Teaming information

- Team size: 1 or 2
- One team can work on multiple problems
- One person can only join one team
- The team numbers for each problem will be announced after your first-time selection
- You can switch to another problem or select multiple problems
- Team registration link
- Deadline: 6 PM EDT (8/12/2025)



Submission

- Step-1: Create a GitHub repository.
- Step-2: Add the technical team member(s) to your GitHub repository.
- Step-3: Upload slides and final results.
- Step-4: Codes are optional.
- Rubrics depend on technical problems and judges.

- Final Presentation on *Sunday, August 17, 2025*. Specific time/place and virtual meeting links to follow next week.
- In-person: If you are at IDETC-CIE, there will be free lunch and coffee.
- Virtual: Please attend virtual meetings to present at your scheduled time.

Financial Support Recipients

- Congratulations to the Travel Award & Fee Reimbursement recipients!
- The award is conditioned upon finishing the hackathon and checking in with Prof. Yaoyao Zhao on Aug 17th.
- Financial support will be disbursed in the form of checks.

Travel Awards Recipients:

Yuanzhe	Deng
Athul	Chakkithara Dharmarajan
Hirish	Chandrasekaran
Yuewan	Sun
Haoyang	Xie
Pawornwan	Thongmak
Yuxuan	Xie
Yi-Ping	Chen
Hugo	Rodriguez
Zhengkun	Feng
Gourav	Kumbhojkar
Vispi	Karkaria

Fee Reimbursement Recipients:

Hoang Anh	Nguyen
Amirhossein	Iranmehr
Armin	Hassanirad
Randy	El Haddad
Daniel	Amoshie
Balavignesh	Vemparala Narayana Murthy
Shashank	Kushwaha
Bhairav	Phukan
Kiarash	Naghavi Khanghah
Felix	
Natalie	Ayoub
Hyeonsu	Lee
Shiv	Ratn
Rishabh	Jain

ASME Hackathon 2025 MEME Challenge

An idea, behavior, or style that spreads by means of imitation from person to person within a culture and often carries symbolic meaning representing a particular phenomenon or theme. -Wiki

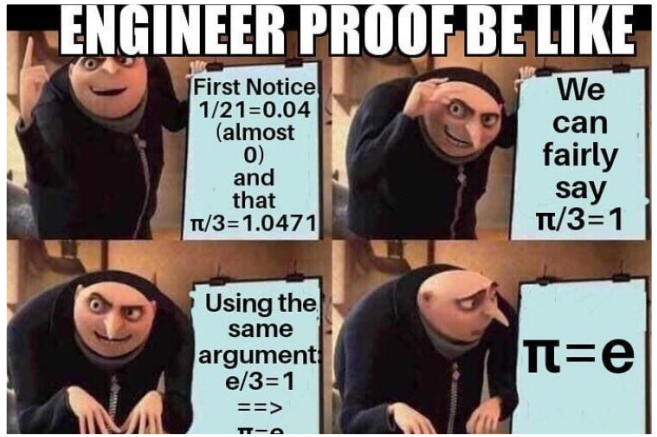
Using CV for Segmentation

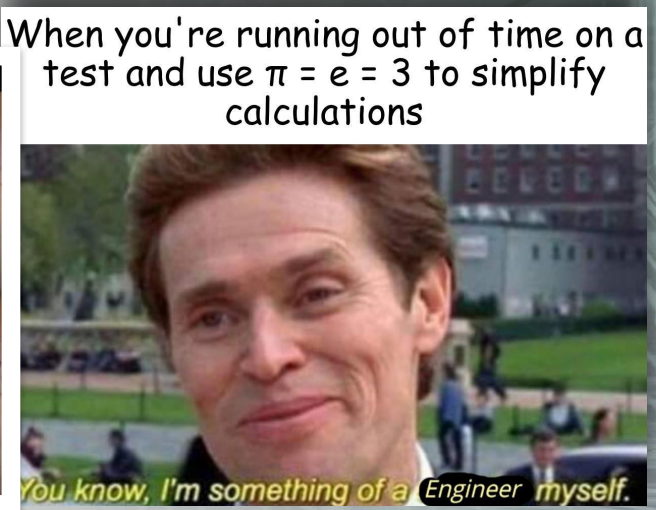
Counting Pixels by Hand

Gift card awards

- 1st place: $50
- 2nd place: $25
- 3rd place: $25

* Based on the number of reactions





Acknowledgment

- **Hackathon Participants**
- **Problem providers:**
  - NIST
  - Autodesk
  - nTop
- **ASME Staff Support**: Barbara Zlatnik, Keli Bell-Cole.
- **CIE Division Executive Committee Representatives**: Krishnanand Kaipa, John Steuben
- **ASME Hackathon 2025 Committee Members**:
  - Prof. Yaoyao Fiona Zhao (McGill University), yaoyao.zhao@mcgill.ca
  - Prof. Zhenghui Sha (University of Texas – Austin), zsha@austin.utxas.edu
  - Prof. Hyunwoong Ko (Arizona State University), hyunwoong.ko@asu.edu
  - Dr. Zhuo Yang (National Institute of Standards and Technologies), zhuo.yang@nist.gov
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  - Dr. Yan Lu (National Institute of Standards and Technologies), yan.lu@nist.gov
  - Jiarui Xie (McGill University), jiarui.xie@mail.mcgill.ca

Participant Socialization

- What's your name, and where are you joining from?
- What's your background or area of interest?
- Have you ever participated in a hackathon before?
- What do you hope to get out of this event?