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Meeting Minutes of the Technical Guidance Committee In-Person Meeting

Hyatt Regency Downtown Houston, Texas

December 8, 2025

Scheduled Meeting Time 2:30 – 4:00 PM

Reply to: Patrick Lang

Southwest Research Institute, 6220 Culebra Road San Antonio, TX 78228

Phone: 210-522-2820, patrick.lang@swri.org

The meeting was called to order at 2:30 PM by Chairman Pat Lang.

Agenda:

The meeting agenda can be found as attachment #1.

Membership Review:

The attendance list can be found as attachment #2.

Review and Acceptance of Minutes:

The minutes from the June 23, 2025 meeting in Kansas City had not been posted yet at the time of this meeting.

Action Item List:

The action item list was reviewed; see Attachment #3 for more details.

Fuels Task Force:

Pat Lang reported that there has been no activity in the fuels task force this period. All of the action items have been completed. If there are any new items to be added, please contact Mike Lochte at SwRI or the TGC chairman.

Rating Task Force:

Bob Campbell provided the rating task force update; the full report can be found as Attachment #4.

- No action on the deposit side since spring workshop
    - Reported details during June ASTM
- Gears
    - New rating aid developed and in deployment
        - Specific to Gleason gears
        - Circulated within rater community and during L-test panel meetings last month
        - Will be used during Jan workshop
        - Group will move to 0.5 (from 1.0) increment ratings
        - More granularity = better precision
- Jan workshop will be “trial run” for Deposit-type calibration workshop
    - Hopefully transition away from current RCMS
        - Standardize with Deposit format
- Next full workshop may be moved from the normal spring timeframe to early fall.

A question was asked on how people that are not associated directly with a lab can get rating training. Some background here is that the normal rating workshops have been very strict on the fact that the workshop is not a training session. In the past people without rating experience were showing up to the workshops looking for training and this hindered the progress of the workshop. The annual workshop is solely for calibrating the mainstream lab raters.

AL Lopez suggested the TMC provide a rater training service. Jeff Clark stated that the TMC is willing to facilitate training but in the past they have tried to do this with the field raters and there was not enough people in attendance to justify it. The suggestion was made that anyone looking for rating training should contact one of the labs with calibrated raters and contract them for training.

Bob reported that VH oil screen clogging (OSC) will continue to be an item of review in the workshops.

Statistics Topics:

No stats topics were discussed during this meeting.

Old Business:

Test Out-of-Control Document

Pat Lang reported that the "Out-of-Control" document review task force did not meet this period.

New Business:

VH Oil Screen Digital Rating:

Phil Scinto presented a study done at Lubrizol where they compared human eye ratings of VH oil screens to image-based ratings using Convolutional Neural Network (CNN) for the analysis. The data set used for the analysis was a combination of 12 raters rating 10 oil screen photos at a rater workshop, raters at the Wickliffe lab rating 210 physical screens and rating images of those same 210 screens. The results of the experiment showed that CNN does well in the low (0-20) and high (80-100) range of the sludge ratings. One of the challenges is that the sludge rating is not a discrete value. If it were, the performance of CNN would improve greatly. A bigger and more diverse dataset is needed to take this to the next level.

There is no immediate plan at this point to do anything further with this image analysis approach to VH OSC rating. Lubrizol just wanted to bring this work to the attention of the panel since variability in this rating has been discussed extensively within the rating task force. This method could potentially be something to consider in the future to improve the rating precision. A comprehensive presentation of the work can be found as attachment #5.

There was some more general discussions around OSC rating during this presentation. Steven Kirby of GM stated that oil screen clogging is an important item for OEMs. Jason Bowden commented that there is a disconnect with this rating in that 100% screen clogging doesn't mean the engine is starving for oil. Labs have confirmed that tests that have a 100% OSC rating at EOT do not exhibit oil pressure loss or drop during the test. Another distinction on OSC rating is whether the clogging is the result of sludge or debris and can the algorithm in a digital rating system decipher them.

Surveillance Panel Chair Handbook

Mike Deegan commented that he feels it would be beneficial to offer a training session on the use of the Surveillance Panel Chairman Handbook. There are a lot of new people in the industry, and a training session could be very helpful in educating new people. The TGC chair will look for opportunities to offer a training session.

An additional discussion took place on the dissemination of the handbook to groups outside of the engine testing areas. YongLi McFarland commented that she doesn't think a lot of the bench test people are participating in the TGC activities and it may be due to lack of awareness. Additionally, she doesn't think that the surveillance panel chairs have thoroughly made their panel members aware of the handbook and where to find it.

The action item on this comment is that the TGC chair will ensure that the dissemination of any information includes all groups and will encourage the surveillance panel chairs to keep their panels up to date on the TGC activities.

The meeting adjourned at 3:00 PM

Next Meeting:

The next meeting will be at the call of the chairman.

Attachment #1

Agenda

December 8, 2025

AGENDA

ASTM Technical Guidance Committee Meeting

Patrick Lang – Chairman
Monday December 8, 2025 – 1:30 PM
Hyatt Regency Downtown Houston
Meeting Room: Sandalwood-Fourth Level

1. Attendance
2. Chairman's Comments
3. Meeting Minutes
    - 3.1. June 23, 2025, meeting minutes (Kansas City).
4. Review Action Item List (Pat Lang)
5. Fuels Task Force Update
    - 5.1. No Activity during this period (all action items have been addressed).
6. Rating Task Force Update (Bob Campbell)
7. Stats Topics
    - 7.1. No new items for this reporting period.
8. Old Business
    - 8.1. Update on the review of "Out-of-Control" document (Pat Lang).
9. New Business
    - 9.1. Digital Ratings (Phil Scinto).
    - 9.2. Updates to Surveillance Panel Chairman Handbook/new topics/training.
10. Next Meeting: To be determined
11. Adjournment

Attachment #2

Attendance List

December 8, 2025

Technical Guidance Committee----Voting Membership List 12-8-25

NAME	COMPANY AND ADDRESS	PHONE NUMBER E-MAIL ADDRESS
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		Phone: e-mail:

Attachment #3

Action Item List

December 8, 2025

Technical Guidance Committee (TGC)

Action Items List Status as of 12-8-25:

1. Action Item – TGC to review the current document for "out of control" tests.

    - ***In process***

2. Action Item – TGC to work on generating test procedure wording that would address the handling of testing anomalies.

    - ***Open***

Attachment #4

Rating Task Force Report

December 8, 2025

Rater Task Force Update to TGC

Dec 8, 2025

Passion for Solutions®

Since last time…..

- Deposit Workshop
  - No action since Spring workshop
    - Reported during June ASTM
- Gear Rating
  - Lots of work this year

Gear Ratings

- New rating aid developed and in deployment
  - Specific to Gleason gears
  - Circulated within rater community and during L-test panel meetings last month
  - Will be used during Jan workshop
  - Group will move to 0.5 (from 1.0) increment ratings
    - More granularity = better precision
- Jan workshop will be “trial run” for Deposit-type calibration workshop
  - Hopeful transition away from current RCMS
    - Standardize with Deposit format

Next Meetings….

- Teams call scheduled 1/7/2026, 1pm EST
  - Gear group discussion regarding new format
  - Discuss deposit workshop calendar

- Current discussions to move to late Summer/early Fall
  - Date undetermined

Manual 20 Info

Contact Information for TMC Manuals 20 & 21 and other rating scales and aids :

Yvonnie Reese

ASTM International

100 Barr Harbor Drive

West Conshohocken, PA 19428

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Attachment #5

Digital Rating Presentation

December 8, 2025

A Case Study in Image Analysis
VH Oil Screen Sludge

ASTM TGC Meeting

Monday, December 8, 2025

Houston, TX

Based on the work of Quinn Frank, Anja Zgodic and Hongjing Mao

Lubrizol

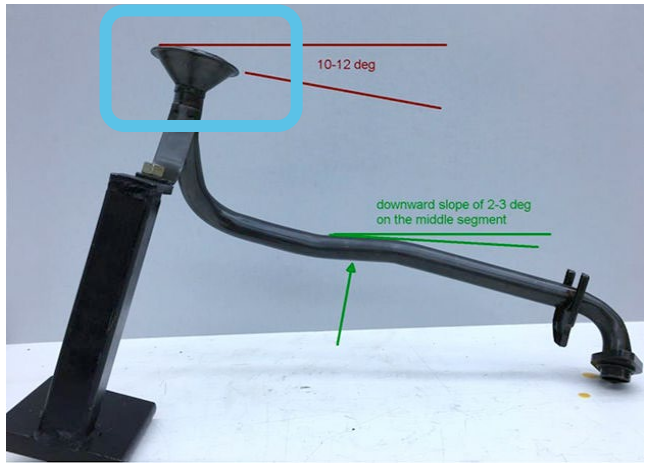
Imagined for Life. Enabled by Science.™

Agenda

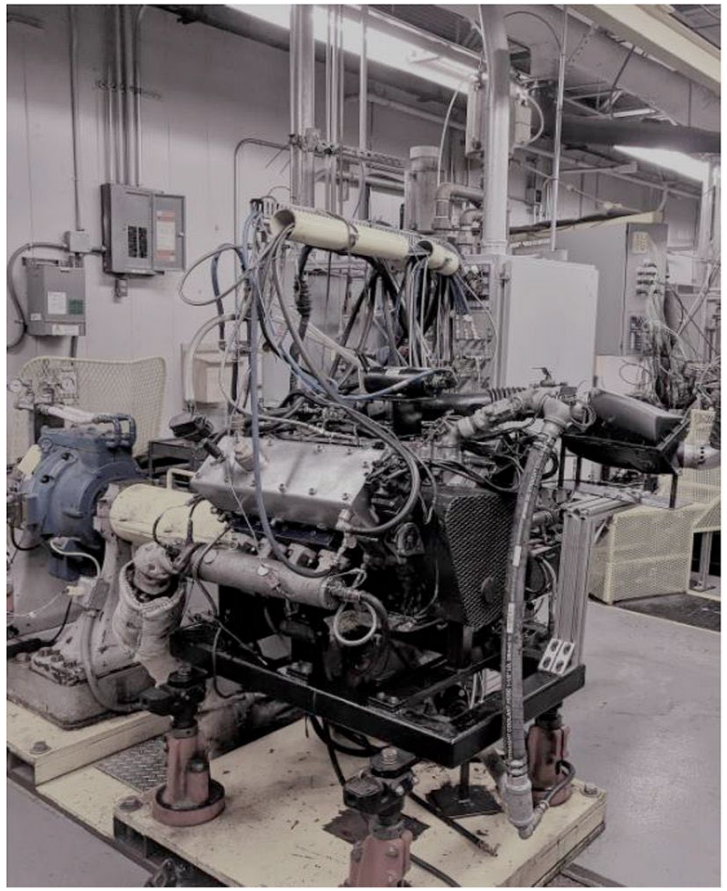
- Background on oil screen sludge metric
- Project Problem Statement and Objectives
- Sources of Sequence VH Data
- Methods
  - Convolutional neural networks
    - Image processing
    - Data augmentation
    - Regression
- Results
- Discussion

Background

- How do we measure Oil Screen Clogging?
  - In the engine disassembly, technicians find the oil 'pick-up tube'



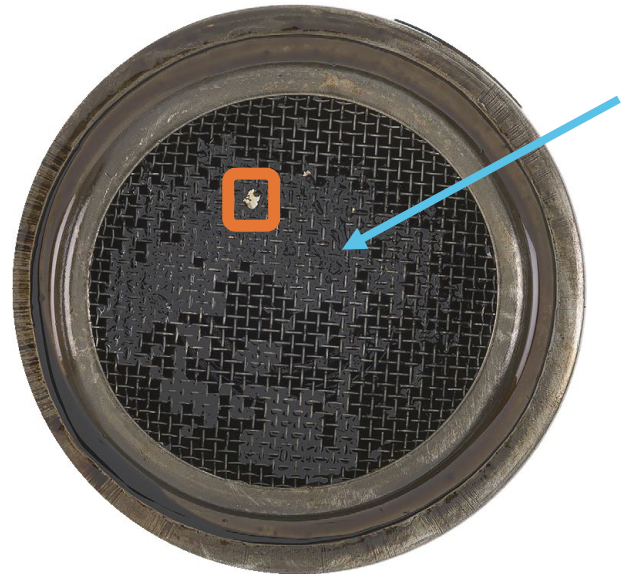
Oil Pick-Up Tube
Source: ASTM D2658



  - On the pick-up tube, there is the screen that stops large particles from getting into the oil pump

Background

- How do we measure Oil Screen Clogging?
  - The screen aims to prevent solids and viscous residue in the engine oil from reaching the oil pump
  - At EOT, the screen is removed from the engine and hung to allow excess engine oil to drain off for 4-8 hours
  - After 4-8 hours, a rater assesses the percentage of the screen area that is totally obscured
    - Debris: bits of metal or other non-oil substance
    - Sludge: dark-colored substance stuck to top of wire screen



Background

- In-person inspection yields oil screen sludge area coverage rating in [0%, 100%]
- Procedure for report: also take photo of screen (+ other parts) under standard conditions
  - Supposed to happen within 8 hours of manual rating, but often takes longer

Problem Statement

- Between-rater variability is an important consideration for VH oil screen sludge rating
  1. Manual rating is imprecise and subjective (what does “totally obscured” mean?)
  2. Difference between in-person and digital ratings adds additional variability

Objectives

1. Compare in-person ratings to image-based ratings
2. Leverage existing image data and rater scores
3. Assess possibility of determining oil screen sludge from images
   a) Compare method error to between-rater variability
   b) Evaluate bias of image-based prediction
   c) Evaluate variance arising from different photo conditions

Data Sources of Sequence VH Test Results

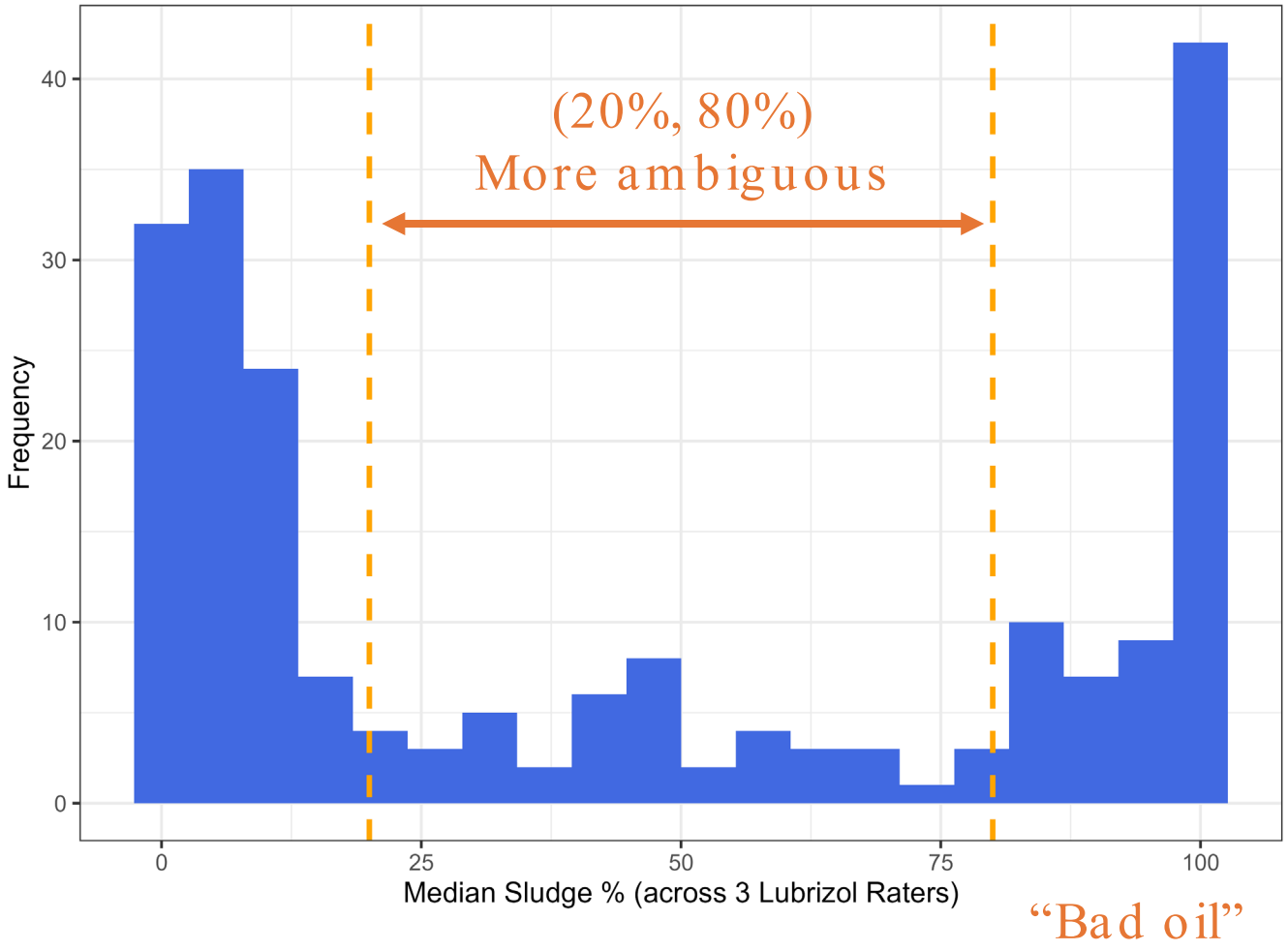
1. ASTM TMC workshop: 12 raters rated 10 screen images for Sequence VH oil screen sludge (ULTIMATE TEST DATASET)

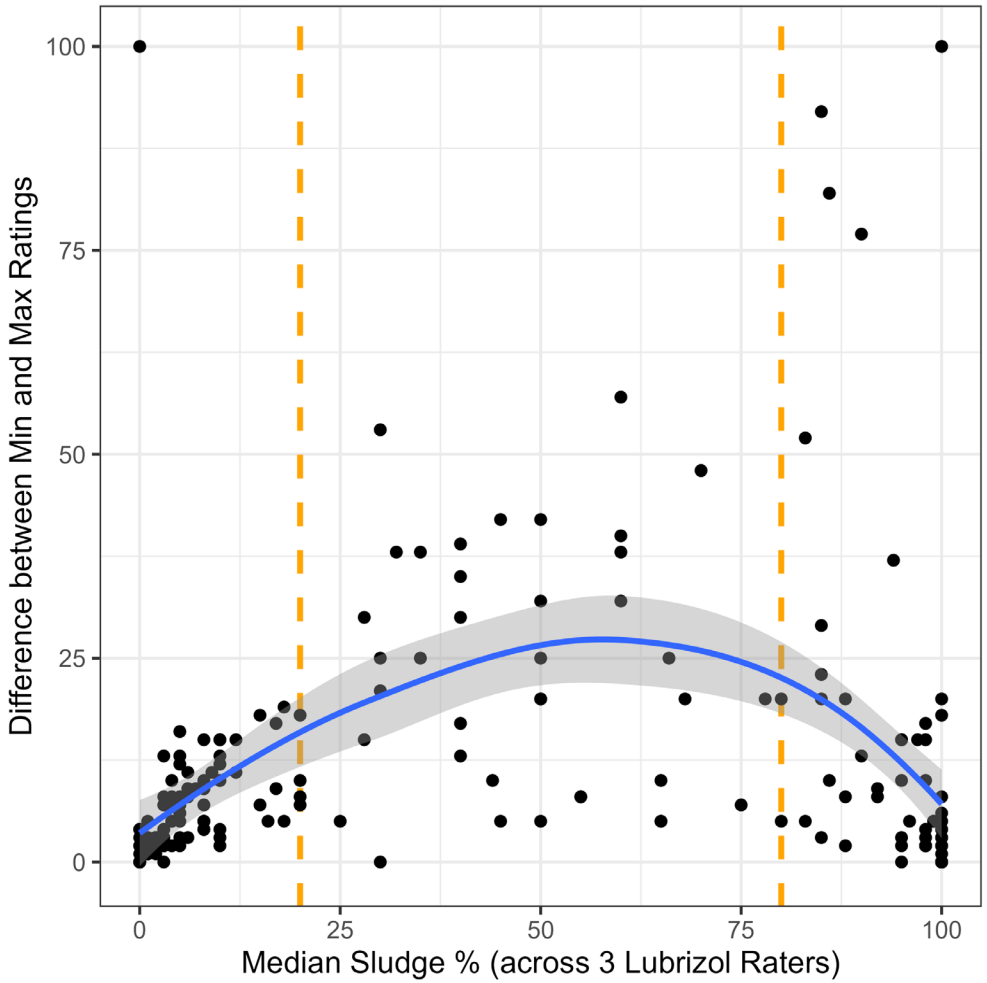
2. Wickliffe Lab: we have 1 rating for 210 physical screens for Sequence VH oil screen sludge (raters have changed over past 10 years)

3. Experiment: had 2 raters, rate the images of the 210 screens above

Data Sources of Sequence VH Test Results

2 3





Methods - Overview

- Objectives - Reminders
  1. Compare in-person ratings to image-based ratings
  2. Leverage existing image data and rater scores
  3. Propose possible process for determining oil screen sludge from images
- Analysis - Approach
  - Convolutional neural network (CNN) to predict oil screen sludge rating based on image, accounting for physical screen vs. scre[illegible]g
    - Data: image, rating type (physical or image), rating

1 2 3

Methods – Convolutional Neural Network

- First need to process images to eliminate additional noise
- Want CNN to predict oil screen sludge [0%, 100%] based on a processed image
  - Need to establish a single "ground truth" rating from our data
- For efficiency, we use a pre-trained model (ResNet-18)
  - Fine-tune using our internal dataset [2] [3]
  - Generate synthetic data to augment our images and improve model training
- Evaluate using our ASTM dataset [1], which has a completely different origin

Methods – CNN – Image Processing

- Images for [2] [3] scraped from internal reports
  - Algorithm identified circular screen from engine parts photos
  - Used heuristic to isolate the inner screen (rim not relevant for ratings)
- Key challenges
  - Lighting, camera angle, and environmental conditions vary across images
  - Different image resolutions (different cameras)
  - Oil screen sludge is very reflective and has texture/volume → Difficult to gauge from images

Methods – CNN – Rating Combination

- CNN loss function requires a single number as our “ground truth”
- Need to combine 210 Lubrizol image ratings across the three raters [2] [3]
- Opted to use median between the three raters
  - Reminder: 1 rating based on physical screen, 2 ratings based on images (taken some time later)
    - When the 3 diverged, physical rater was usually the outlier
      - Did the screen look very different or were there data entry errors?
  - Median is biased more towards the image raters, since there are twice as many
    - CNN only sees the images, so we 'favor' image raters when there is strong disagreement

Methods – CNN – Weighting

- Incorporate rating type (physical vs. image) via weighting scheme
  - Assumption: screen photos taken around end of test time are closer to physical version
    - If the screen sits for a while, oil screen sludge will move
  - We weigh images based on time elapsed
    - Longer time elapsed → lower weight
- Weighting scheme
  - Calculate elapsed time = photo time - end of test (hours)
  - Apply reverse min-max normalization to elapsed time, assign weights linearly
    - Shortest time (24 hours): weight = 1
    - Longest time (12 days): weight = 0.1
    - If timestamps were missing, assigned weight = 0.5

Methods – CNN – Data Augmentation

1. At an ASTM TMC workshop, 12 raters rated 10 screen images for Sequence VH oil screen sludge

2. At Lubrizol, we have 1 rating for 210 physical screens for Sequence VH oil screen sludge

3. At Lubrizol, 2 additional raters rated images of the 210 screens above

---

4. Augment 2 and 3 by applying distortions/transformations to the 210 images

   - Each distorted/transformed image retains the rater scores and weight of its original

Methods – CNN – Data Augmentation

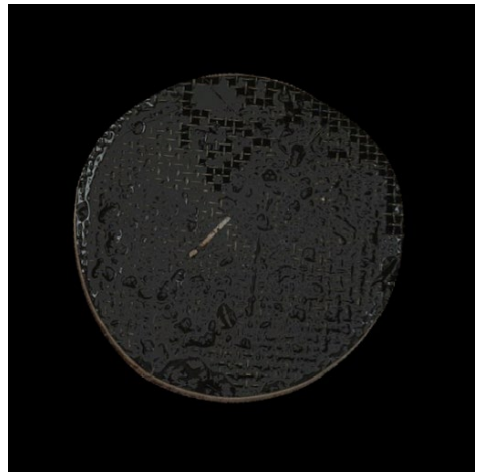
We augment the dataset by applying distortions/transformations to the 210 images 4

- Rotate between -45 and +45 degrees (100%)
- Reflect across x-axis (50%)
- Reflect across y-axis (50%)
- Randomly crop up to 15% from each edge, then pad to return to original size (66%)
  - Acts like a random translation away from the center
- Grid Distortion: add local disturbances via non-rigid deformation of grid points (50%)
- Randomly modify color properties (50%)
  - Brightness ±50%; Contrast ±30%; Saturation ±30%; Hue ±10%
- Contrast-Limited Adaptive Histogram Equalization (CLAHE) to improve local contrast further (33%)
- All transformations applied sequentially, with given probabilities, and can stack
  - Process was applied 10 times for each original image

Methods – CNN – Data Augmentation

- Augmented images:





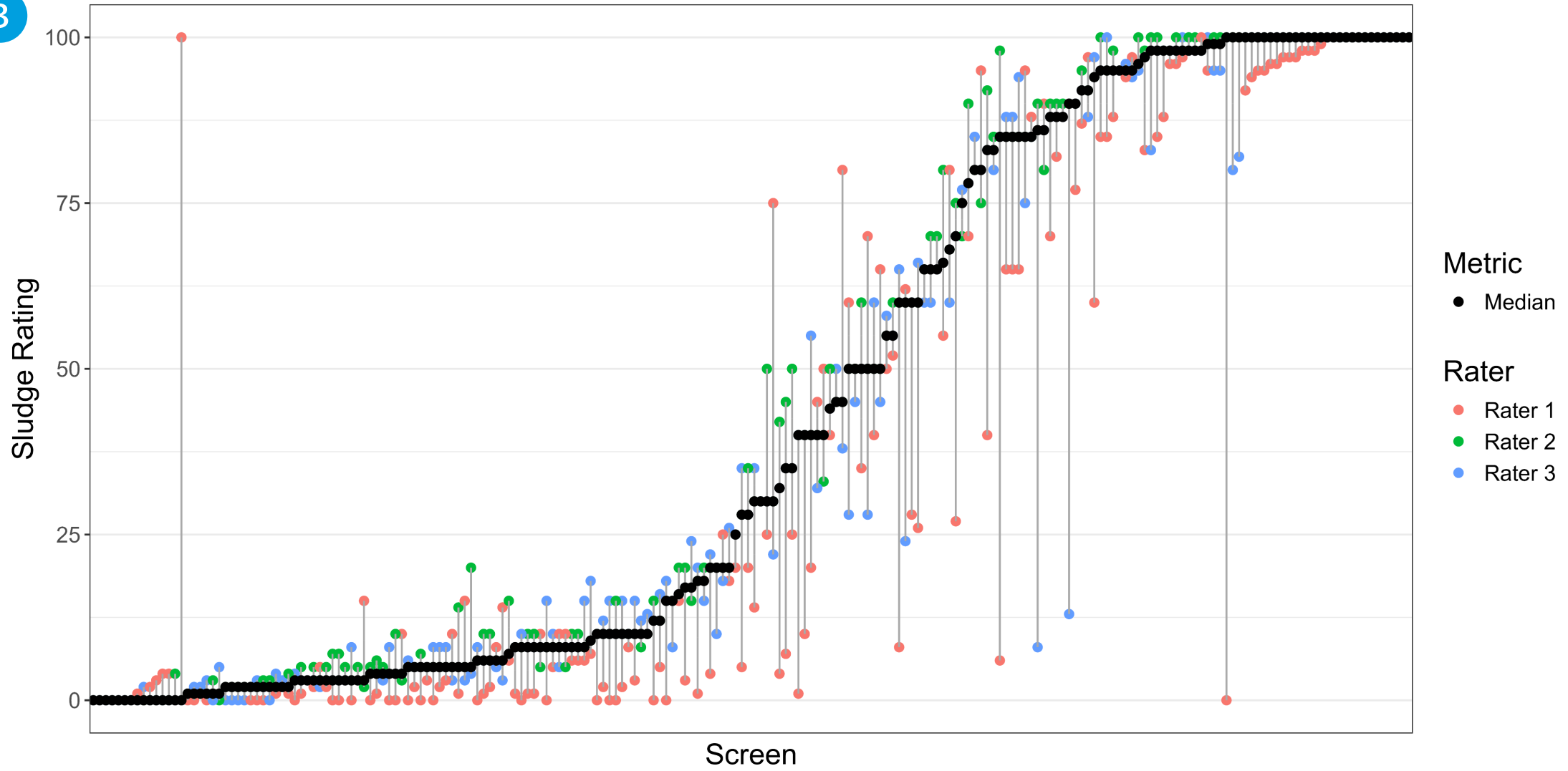

Methods – Convolutional Neural Networks

- Split the augmented data into training and validation sets for 5-fold cross-validation 4
  - Rating distribution is balanced across the training folds
  - Transformed images go in the same fold as their original image
- Initialized model weights (coefficients) from pre-trained ResNet-18 model
  - Feed in our processed training images
  - Use a weighted Mean Squared Error (MSE) loss to move output towards our combined response
  - Pre-trained models speed up this training process by starting closer to a local optimum
- Evaluated with independent separate test set 1
  - 10 screen images from ASTM TMC workshop

Results

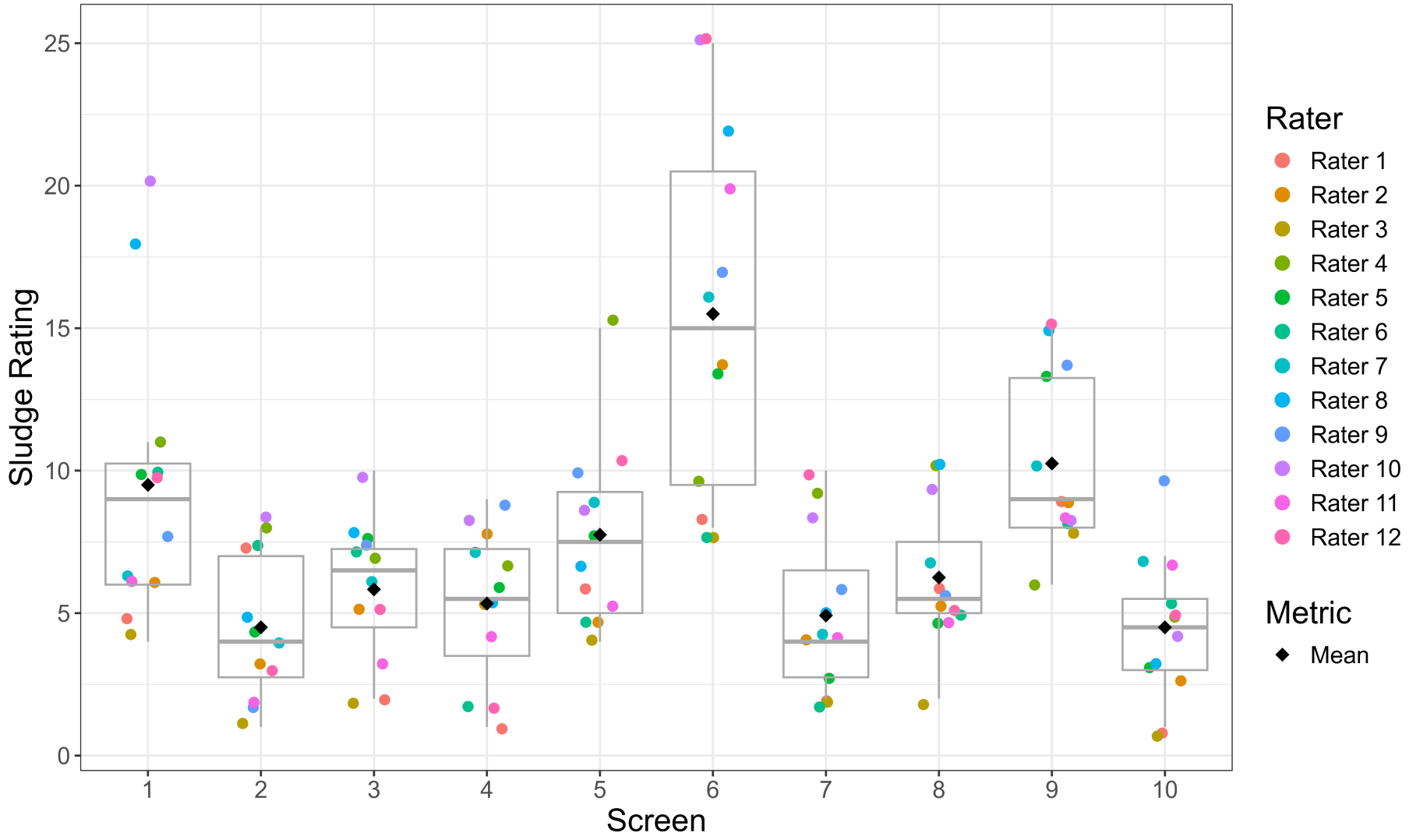
Results – Descriptive (Digital Ratings Typically Higher)

2 3



Results – Descriptive (Workshop Ratings)

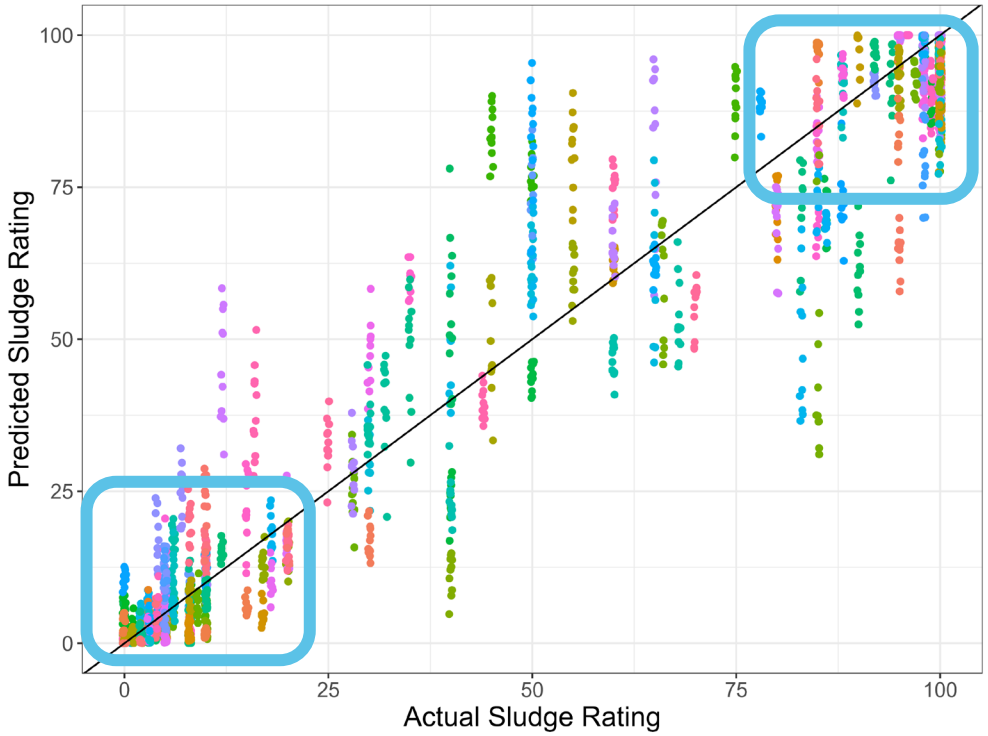
1



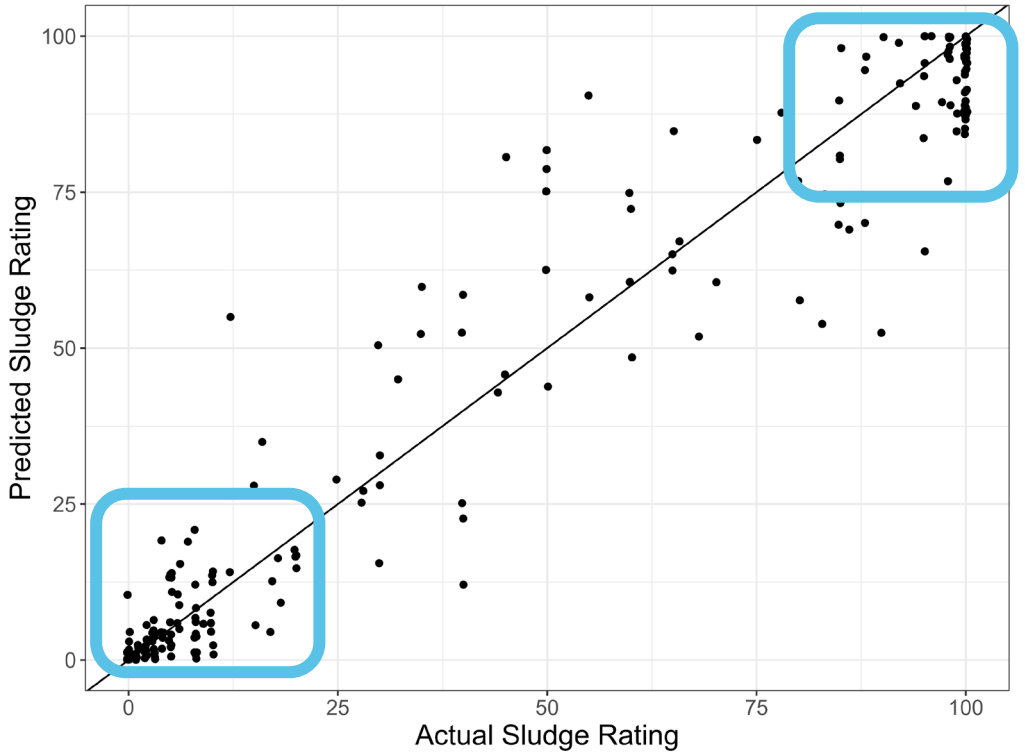
A5-21

Results - CNN

- Model Performance: Predicted vs. Actual oil screen sludge ratings on Validation Set 4
- Root MSE Validation (RMSE, across folds): 10.9
- Better performance in ends of rating range



Original Images Only



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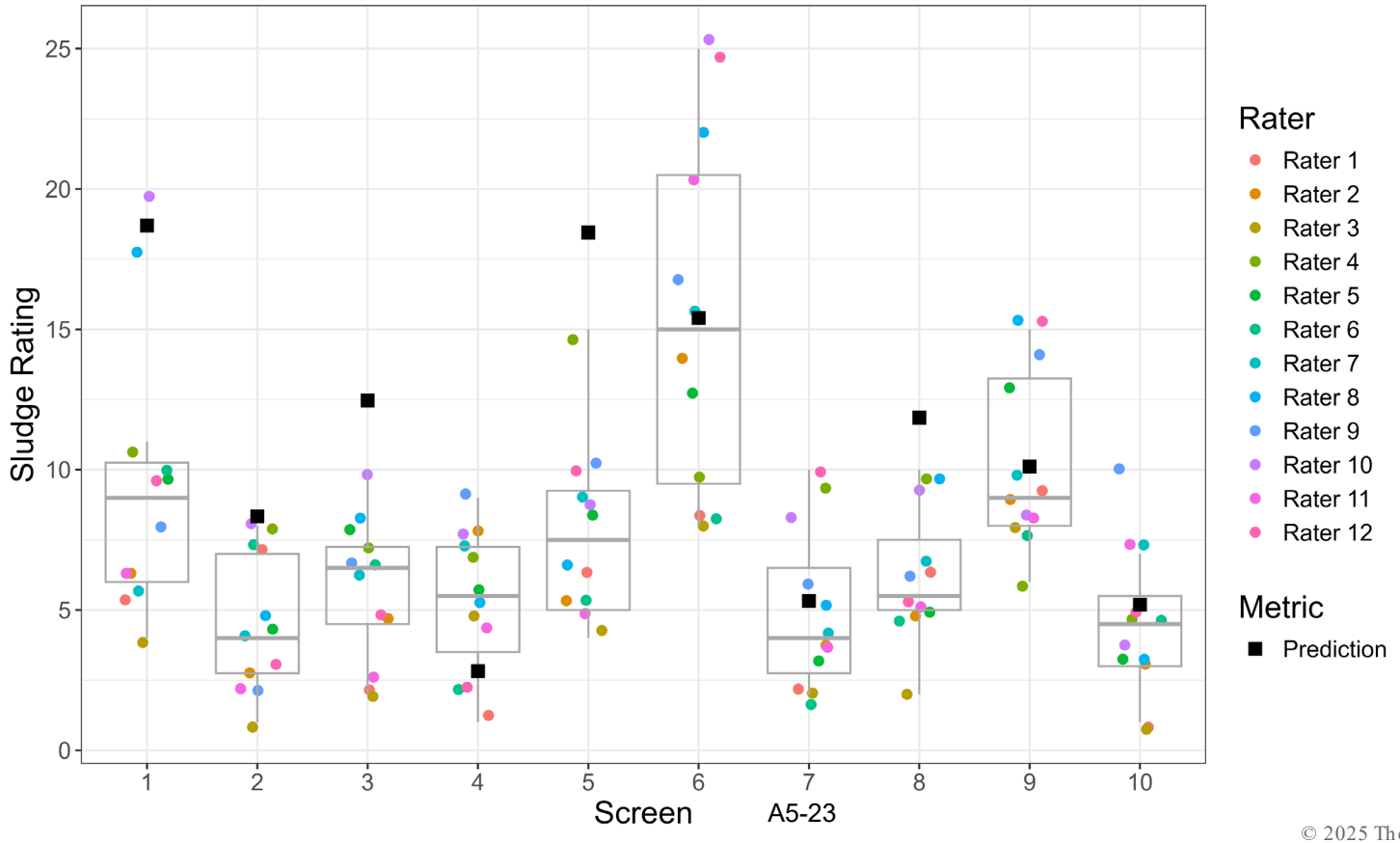
A5-22

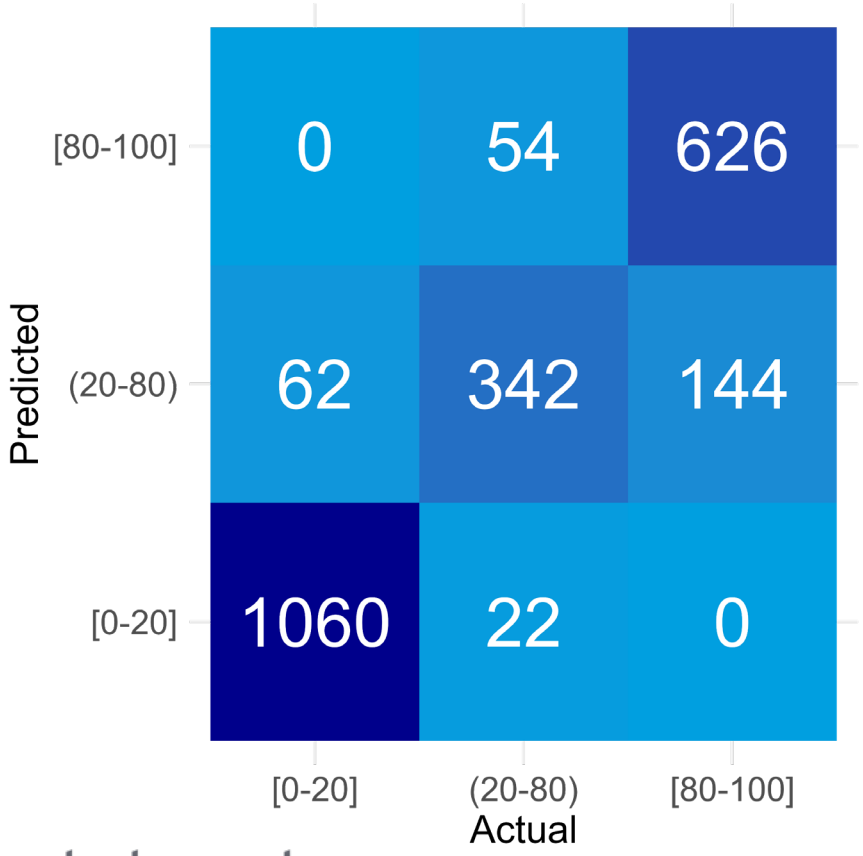
Results - CNN

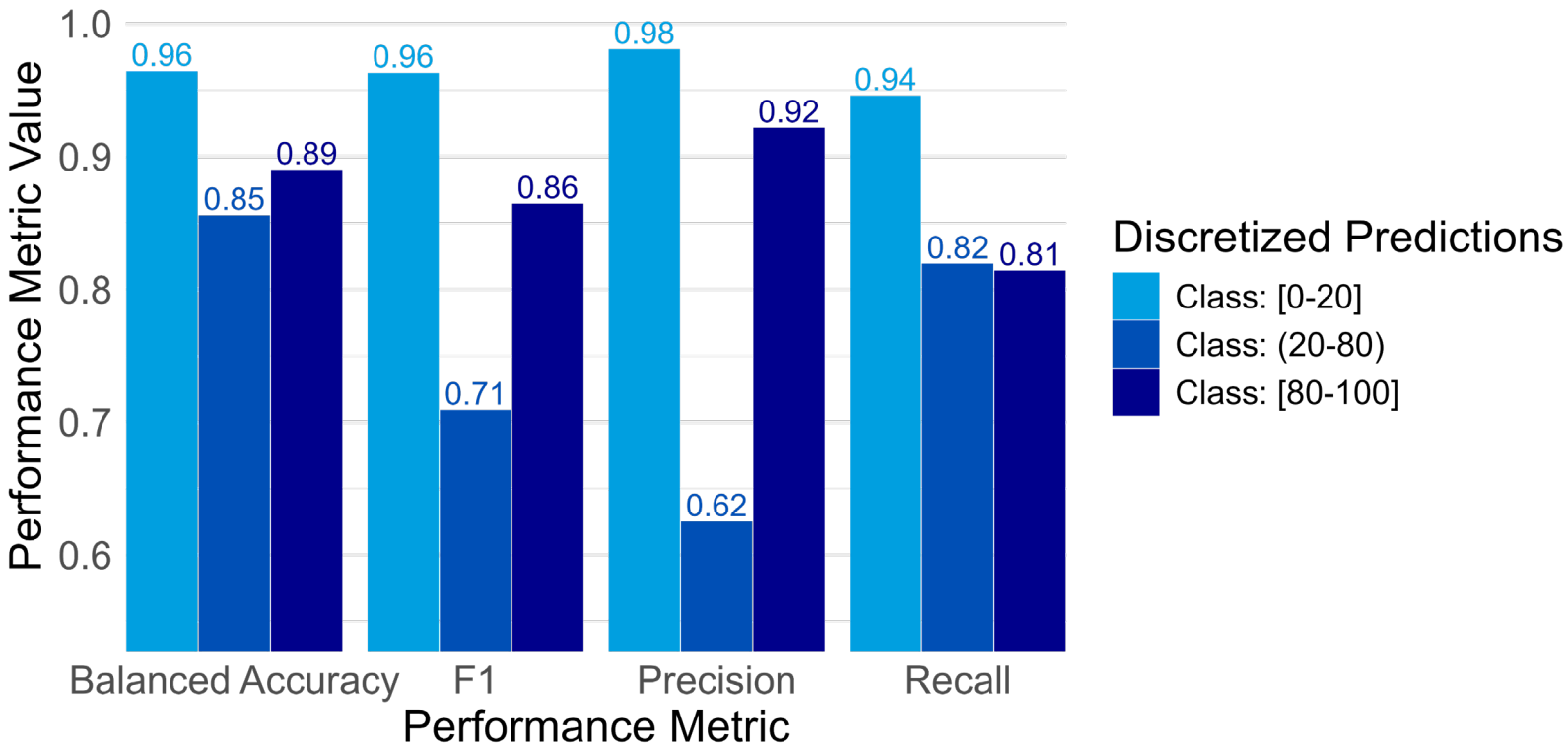
- Model Performance: Predicted vs. Actual oil screen sludge ratings on the Testing Set 1
- Model Predictions tend to be higher
- 6/10 predictions were within range of actual ratings of photos from the 12 raters



Results - CNN

- If we discretize predictions, model performance improves drastically
- Validation Set, 210*11 images (augmented) [4], overall accuracy: 87.8%





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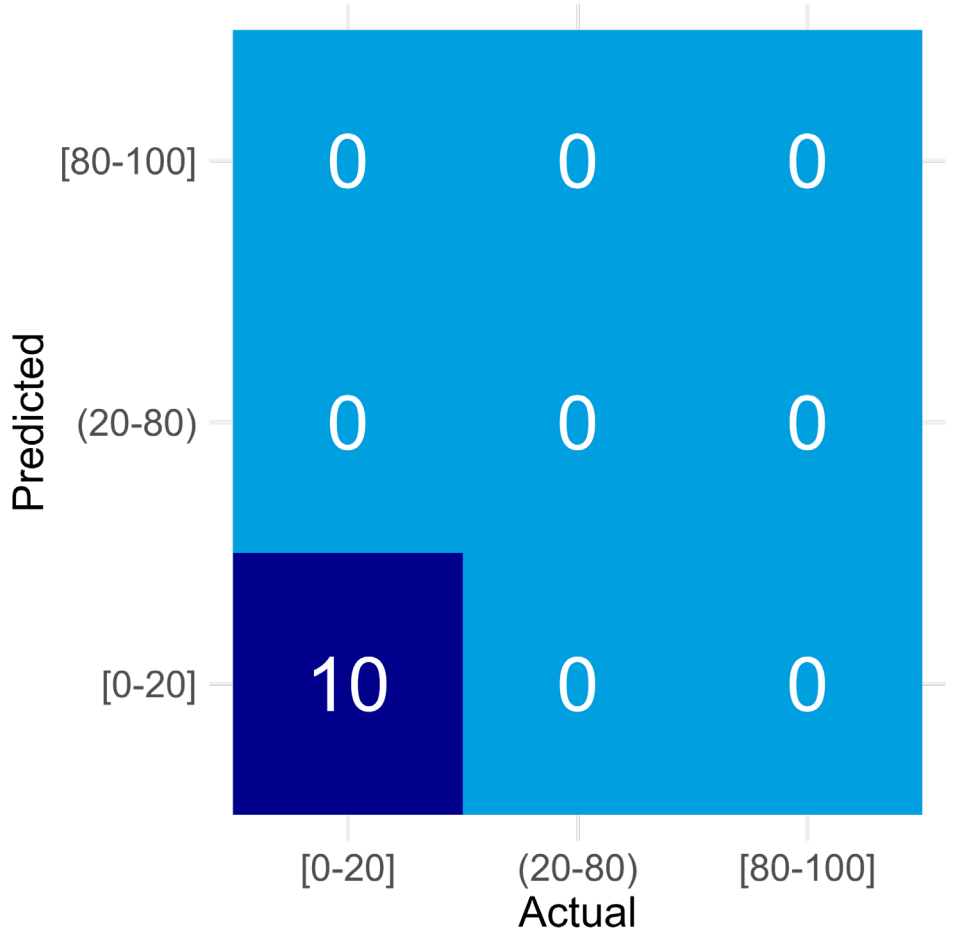
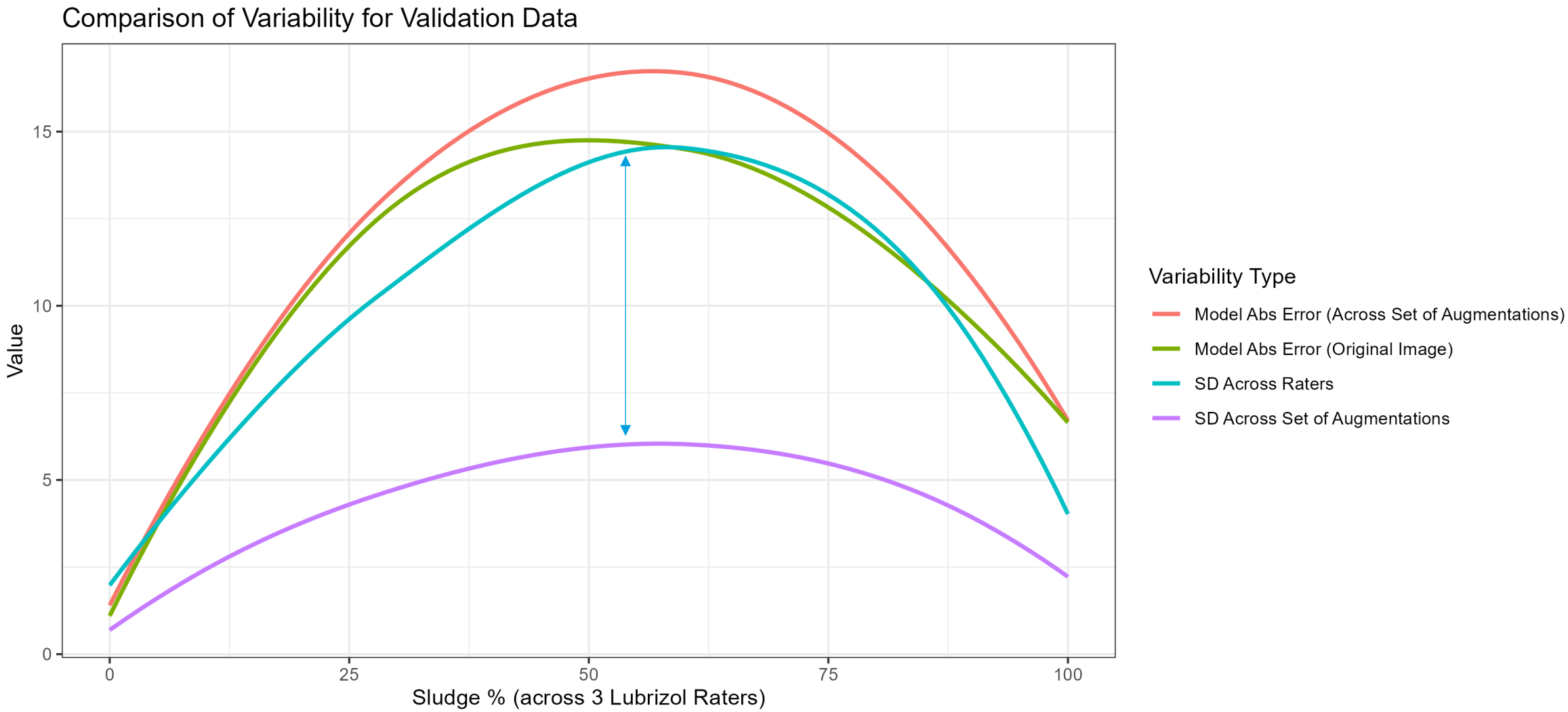
A5-24

Results - CNN

- If we discretize predictions, model performance improves drastically
- Test Set, 10 images 1
- Overall accuracy: 100%, Precision, Recall, F1: 1



Results - CNN



Results - Summary

- Variability in the test AND ratings hinders us in determining the TRUE Oil Screen Sludge
  - What is the true OSC? We may never know
- CNN has low prediction variance but higher prediction bias against 'truth'
  - Tends to predict higher oil screen sludge in this example
- CNN does better in lower [0-20] and higher [80-100] ends of the rating range
- If we treat oil screen sludge as discrete value, CNN performance improves greatly
- Can we develop an automatic, digital approach that improves precision?
  - Need a bigger, more diverse dataset of 'truth'
    - But CNN is a start in solving the problem of high between-rater variability
    - If oil screen sludge is discrete, CNN is a good alternative to in-person rating
      - Model distinguishes "good" and "bad" well and is robust to photography conditions

Possible Next Steps

- First, answer the question
  - Is OSC a viable and meaningful parameter? Are we reading 'too much' into OSC results below 80?
- Confirm 'acceptable' bias between actual and digital ratings based on consensus
- Assemble a 'truth' dataset that is diverse, broad and deep
  - Consensus rating on digital photos ranging from 0 to 100 in OSC (both actual and digital)
  - Test results from at least 4 organizations
  - Divide the dataset into training and test with at least 200 test results in each
- Generate the model and test

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