# Official Rules for the Enhancing Computer Vision for Public Safety Challenge

## Introduction

### Overview

The Public Safety Communications Research (PSCR) Division of the National Institute of Standards and Technology (NIST) is hosting the Enhancing Computer Vision for Public Safety Challenge focused on advancing the capacity of no-reference (NR) metrics and computer vision algorithms for image and video quality analysis, to support public safety missions. PSCR will award prizes valued up to $240,000 to the contestants. The First Responders Network Authority is partnering with PSCR on this challenge. The contestants will provide: 1) datasets of images or videos showing impairments that cause computer vision applications to fail, and 2) innovative methods to estimate the failure rate of computer vision algorithms on these images or videos. These solutions will provide the computer vision and NR metric research communities training datasets to ultimately improve analytics for public safety.

### Challenge Background

A roadblock to the deployment of computer vision and video analytics are the myriad problems cameras have when deployed in real world environments.

First responders operate in environments that are very challenging for cameras. Frequently problems include low light, night with bright lights, and the rising or setting sun shining directly into the camera. Obscurants like rain, snow, and airborne dust obscure distant objects. Bodycams and in-car cameras produce severe camera jiggle. First responders often rely on a third party's outdated camera systems that provide low resolution video feeds or low-quality compression. Lenses may be obscured by spider webs, restaurant grease, or other grime. First responders need robust computer vision systems that can operate in these difficult environments. For more information, read NTIA TM-17-524, "Technology Gaps on First Responder Cameras," at https://www.its.bldrdoc.gov/publications/details.aspx?pub=3171

To develop robust systems for public safety, computer vision researchers need an algorithm that predicts the quality of images and videos and performs root cause analysis (RCA). These are referred to as NR metric for image quality assessment (IQA) or video quality assessment (VQA). The NR metric would supplement the camera feed with extra information, such as noting areas of the image where the camera cannot "see." Deployed systems could implement complex strategies, such as dynamically selecting the optimal video analytic or adjusting camera settings.

Today, NR metrics emulate the human perceptual system. This requires subjective testing, where large groups of people assess the quality of images or videos, so the training datasets are small and expensive. Consequently, NR metrics are too inaccurate for computer vision applications. Example NR metric training datasets are publicly available: register for a free account on the Consumer Digital Video Library (https://cdvl.org/); and search for key word "CCRIQ" or "its4s3". Image dataset CCRIQ systematically comparing 23 consumer cameras. Video dataset its4s3 evaluates camera problems using simulated public safety footage.

PSCR is investigating solutions to train NR metrics for computer vision applications. This would require datasets of images or videos showing impairments that cause computer vision applications to fail, as well as strategies for calculating the failure rates of computer vision algorithms (e.g., correct classification rate, misclassification rate, likelihood scores, image ambiguity, image difficulty, or meta-recognition). The resulting data will identify which camera impairments cause problems for computer vision. If the viability of this approach could be proven, the cost of data to train NR metrics and RCA would be reduced, resulting in significant gains for public safety analytics and the wider research community.

An additional problem is that most NR metrics only predict overall quality. Computer vision applications need RCA to identify and respond to specific image and video quality problems. Therefore, PSCR is seeking image and video datasets to train NR metric RCA algorithms, as well as strategies for creating this training data. The dataset creation strategies could enable a new line of research.

This challenge focuses on how computer vision differs from the human visual system, when "looking at" photographs and videos with real camera impairments. Simulated impairments are intentionally excluded. Likewise, this challenge focuses on high performing computer vision algorithms. There is a separate line of research where images are modified to identify failure cases of computer vision algorithms; these investigations are not relevant to this challenge.

## Challenge Goals and Objectives

The goal of this challenge is to enhance the research capacity of NR metrics, computer vision algorithms, and image quality analysis for public safety officials. This challenge also seeks to convene members of these disparate research communities to advance the state of image and video quality analysis for public safety.

Each dataset solution can either focus on a specific camera problem (e.g., lens flare) or a specific computer vision application (e.g., automated driving). Each dataset will include the following elements:

1. 250+ images or videos (5 seconds duration or less) that portray a wide range of visual quality, subject matter, and environmental conditions
2. Numerical data that estimates the likelihood that a computer vision application will fail
3. Category data that can be used to subdivide the images into useful subsets
4. A short document that describes the dataset and assessment method

After the challenge, the datasets will be used for image quality research and development (R&D) purposes.

PSCR hypothesizes that developing new training datasets for NR metric research can replace expensive subjective testing with accuracy estimates from computer vision algorithms. This will help PSCR achieve the development of robust image and video analytics for public safety applications. This goal is two-fold:

1. Create and distribute a set of images or videos (5 seconds duration or less) that represent either a) one specific camera impairment with content suitable for various computer vision applications, or b) a variety of camera impairments with content suitable for one computer vision application. All images and videos must be from modern cameras (i.e., no synthetic or simulated impairments). At the contestant's discretion, these images or videos will be freely distributed for research and development purposes following the conclusion of the challenge. This will provide the research community with valuable datasets. If the contestant chooses to distribute the images or videos, the datasets will be distributed via the National Telecommunications and Information Administration's (NTIA) Consumer Digital Video Library (CDVL). NTIA, a part of the U.S. Department of Commerce, conducts NR metric research and provides PSCR with video quality assessment expertise.

2. Create a method to assess the failure rates of a specific computer vision algorithm and apply this method to the contestant's images or videos. Possible solutions include but are not limited to correct classification rate, misclassification rate, likelihood score, image ambiguity, image difficulty, and meta-recognition. The failure rates must be expressed as a percentage or fraction. The method must be described in sufficient detail that another researcher or developer could apply the method to their own images or videos, using their own computer vision algorithm. At the contestant's discretion, the contestant may optionally identify areas of the image or video where the computer vision algorithm fails.

For this challenge, failure rate is whether or not the computer vision algorithm can make a reliable decision. Contestants should choose a method to assess failure rate that is synergistic with this challenge's goal of understanding how camera impairments impact computer vision algorithms. Contestants should apply the reliability measure that is most appropriate to the application of choice based on the current state of the art. Of most interest are (a) failure rate assessment methods that can be applied to any computer vision system, and (b) failure rate assessment methods designed for computer vision algorithms that specifically target public safety and first responder needs.

This contest focuses on camera impairments and real-world camera impairments caused by complex interactions between the camera and the environment. Of particular interest are the difficult environments that cause problems for first responders and their cameras, including low light, night, dawn, dusk, rain, snow, airborne dust, grimy lenses, camera jiggle, motion blur, and camera quality impairments caused by flashing lights on first responder vehicles.

Successful solutions will, in the future, be used to separate camera quality problems from video analytics so that analytics researchers can use these computer resources instead of trying to solve this problem

themselves. The winning solution would also eliminate the roadblock between developing the algorithm and deploying public safety analytics.

In addition to the above, this challenge contributes to the PSCR mission by expanding the research community while making the public aware of the public safety use case and NIST's research in this area.

The phases of the challenge follow:

| Phases | Review Criteria Summary | Number of Contestants Eligible to Compete | Awards | Total $ |
|---|---|---|---|---|
| **Phase 1 - Concept Paper** | Relevant expertise, viable image collection plan, plausible assessment method | Open to all eligible contestants | Up to 10 contestants will be awarded: a) invitation to Phase 2; and b) $5,000 for dataset creation | Up to $50,000 |
| **Phase 2 – Dataset Submission** | Diverse subject matter, interesting impairments, detailed description including self-assessment | Open to up to 10 contestants | Up to 10 contestants will be awarded: a) $6,000 per team and b) $12,000 per team that provides datasets to CDVL for further R&D*. Two optional "Best in Show" prizes at $5,000 each may be awarded at the discretion of the Judging panel. | Up to $190,000 |

\* **CDVL Distribution Prize:** Each Phase 2 submission may qualify for an additional prize by granting NIST permission to redistribute the submission package (i.e., images or videos, spreadsheet, and document) on the Consumer Digital Video Library (CDVL, www.cdvl.org) for research and development (R&D) purposes. The submission must pass Phase 2 Criterion # 1 to be eligible (see page 10). Granting NIST permission to redistribute the submission package on the CDVL includes agreeing to the CDVL licensing terms, which are available at https://cdvl.org/license/.

## Definitions

The following is a summary of the various roles and definitions of the contestants and other Challenge contestants:

Phase 1 Contestants:

- Write and submit a concept paper for either the Specific Camera Impairment category or the Single Computer Vision Application category, but not both

- Propose a method to assess the failure rate of computer vision applications
- Describe how they will create the set of images or videos that will be assessed using the proposed method
- Propose cameras that will be used (synthetic impairments are not allowed)
- Describe any aspect of the proposal that specifically addresses first responder needs for computer vision, video analytics, and image analytics
- Describe which difficult camera environments will be used

Phase 2 Contestants:

- Implement the experiment design submitted in the Concept Paper Phase 1
- Create and submit a dataset of 250+ images or 250+ videos
- Obtain license releases for people depicted where necessary. Generally speaking,
    - No consent agreement is needed for "public filming" where there is no reasonable expectation of privacy; these are typically crowd scenes
    - Otherwise, people must be under an appropriate notice and sign a consent agreement
- Create and submit failure rates for each image or video
- Optionally, identify specific areas of each image or video where the computer vision algorithm fails
- Manually create and submit categorical data that can be used to subdivide the images or videos (e.g., by impairment severity or type of impairment)
- Write and submit a paper that summarizes the experiment design as implemented, including unforeseen deviations from the concept paper and a self-assessment of the experience (e.g., successes and failures)
- Contestants shall not be required to submit source code or any proprietary information

Official Representative: Designated point of contact for each contestant for PSCR. The Official Representative (individual or team lead, in the case of a group project) must be age 18 or older and a U.S. citizen or permanent resident of the United States or its territories. That designated individual will be responsible for meeting all entry and evaluation requirements. NIST will award prizes in a single dollar amount to the Official Representative. The Official Representative is solely responsible for allocating any prize amount among member contestants as they deem appropriate.

Subject Matter Expert (SME): An expert in their respective field, either from NIST or from a collaborating entity. Subject matter experts will conduct independent reviews of the submissions received during the Challenge. The subject matter experts are not judges and, as such, will provide recommendations based on the evaluation criteria to the Judging panel.

Judging panel: The Director of NIST, Dr. Walter Copan, will select members from the public safety industry, first responders, and PSCR to test and evaluate the submissions for the Challenge. The Judging panel will take subject matter expert recommendations into consideration when evaluating contestants' submissions. The Judging panel will make the final determination of awards for the Challenge.

## Program Email Address

For questions about the Official Rules contact psprizes@nist.gov.

## Summary of Important Dates

| Phase | Start Date | Due Date | Award and Notification Date |
|---|---|---|---|
| **Phase 1 - Concept Paper** | September 8, 2020 | October 20, 2020 | October 30, 2020 |
| **Phase 2 – Dataset Submission** | November 3, 2020 | May 4, 2021 | May 19, 2021 |

# Official Rules of the Enhancing Computer Vision for Public Safety Challenge

## Phase 1: Concept Paper

### Introduction

The Concept Paper phase invites all eligible contestants to submit a concept paper outlining their proposed solution, approach, capabilities, knowledge, and skills for this contest. Contestants must document their proposed solution structure for either of the two dataset categories. Contestants will also need to demonstrate their experience with image quality analysis, video quality analysis, computer vision, engineering, photography, or other abilities to create the proposed solution. Contestants who propose using a computer vision algorithm to create assessment data will need to demonstrate their experience with computer vision.

Contestant concept papers will be reviewed by a panel of subject matter experts; the Judging panel will evaluate and select up to 10 contestants to move forward to the next phase of the contest and to receive an award of $5,000.

### Important Dates

Concept Paper: Launch on September 8, 2020, with concept papers due October 20, 2020; Contestants will be notified by October 30, 2020.

## How to Enter

Visit Challenge.gov to review the Official Rules. By **5:00 p.m. Mountain Daylight Time** on October 20, 2020, submit a concept paper by email to psprizes@nist.gov. The concept paper must be a PDF file with a **maximum of 9 pages and a file size of less than 25MB**.

- Review the two PSCR-provided dataset categories included on the Challenge website.
- Complete the submission requirements for the Concept Paper phase by the required date.
- Additional information on how to complete a contestant entry is available on Challenge.gov.
- Note: contestants may submit a concept paper for the specific camera impairment category or the Single Computer Vision Application category, but not both.

## Submission Requirements

The concept paper must conform to the following content requirements:

| Section (Start Each Section on A New Page) | Page Limit | Description |
| --- | --- | --- |
| **Cover Page and Abstract (required)** | 1 page maximum | The cover page must include:<br>• Contestant's Name or Team Name (Team, Organization or Company Name with a complete list of individual team members),<br>• Contestant's Location (City, State/Region and Country). If Team, Organization or Company, must include principle place of business.<br>• Team Logo<br>• Official Representative and their preferred contact information (including email, phone, and physical mailing address).<br>Describe succinctly (500-word MAXIMUM): The unique aspects of the contestant's approach and the potential impact that the proposed approach could have in achieving the goals of the challenge.<br>Note: Do not include proprietary or sensitive information in this summary. |

| Project Description (required) | 6 pages maximum | Addressing the scoring criteria should be your primary objective; therefore, create your concept paper to address the criteria. Below are a few points to consider:<br>● The contestant's knowledge, skills, and capabilities as they relate to the goals of the challenge<br>● The proposed method for assessing the failure rates of computer vision algorithms<br>● Explanation of why the proposed assessment method is appropriate for the chosen application<br>● The computer vision application(s) and how they can be used by first responders<br>● Whether the dataset will contain images or videos<br>● The subject matter that will be depicted in the images, including all important variables (e.g., scene, places, lighting, environment)<br>● The type of impairments that will be depicted, including the equipment and methods to create those impairments<br>● Justification for major design choices<br>● The solution for ensuring appropriate release forms are obtained from people depicted, if these are needed<br>● The proposed cameras<br>● The competitive advantage offered by the contestant's approach or solution |
|---|---|---|
| Information about Key Team Members (required) | 2 pages | The key team members and why they are well-suited to accomplish the project, with supporting information on their qualifications, skills and capabilities. |

NIST makes an independent assessment of each concept paper based on the evaluation criteria. NIST will not review or consider incomplete concept papers. During the review, each subject matter expert and Judging panel member will review entire concept papers to which they are assigned. The review is not done in sections with different reviewers responsible for different assigned sections. Therefore, it is not necessary to repeat information in every part of the concept paper. Do not include sensitive materials in the concept paper, for example, personally identifiable information like social security numbers, nor business sensitive information like tax identification numbers, etc.

## Evaluation Criteria and Judging

Concept Papers will be evaluated based on the following criteria. An evaluation of a submission by the Judging panel does not constitute the NIST's final determination of contestant or submission eligibility.

Criterion #1: Knowledge and Relevance (20%)

This criterion involves consideration of the following factors:

- Team skill set and past experience (e.g., computer vision, video analytics, image analytics, image quality, subjective testing, NR metric development)
- Demonstrated focus on first responder needs in the proposed solution

Criterion #2: Technical Approach (40%)

The extent to which the objective methods to assess the quality of images for computer vision applications meets the goals of the challenge

- Demonstrated knowledge of computer vision and its current limitations
- Plausible and appropriate approach for assessing the failure rate of computer vision algorithms
- Speed, flexibility, and repeatability of the assessment method for future research

Criterion #3: Subject Matter (40%)

The extent to which the image dataset design meets the objectives listed in the goals of the challenge

- Diversity of scenes, locations, objects, lighting, and/or environments to be depicted
- Type and variety of cameras
- Plausible approach for creating a wide range of image or video quality
- Suitable strategy for obtaining image or videos release, when required by privacy concerns

The concept papers will be evaluated based on the criteria above. Each concept paper will be reviewed by at least two subject matter expert reviewers. The concept papers will be assessed using the criteria listed above and then assigned an overall score for each criterion. Scores will not be provided to the contestants. In the case of a tie, the Judging panel will make a determination on the winner(s) based on the criteria and the winner(s) will be invited to compete in Phase 2.

## Scoring for Concept Papers

Each criterion contains two or more sub-criteria, identified in a bulleted list. These sub-criteria are designed to help the reviewers objectively consider all aspects of the concept paper while forming an overall opinion. Reviewers will consider each sub-criterion separately and record their scores on either a Boolean scale (yes / no) or a quality scale (excellent, good, fair, poor, and bad). "Not appropriate" will be noted if the sub-criterion is irrelevant for the submission. Notes may also be recorded, to identify unique or valuable characteristics of the proposal that are not otherwise obvious.

After considering each sub-criterion separately, the reviewers will create an overall score for the criterion on a scale of [0 to 20 points] for criterion #1 and [0 to 40 points] for criteria #2 and #3. This score will reflect an overall score for the concept paper for that topic area, not a mathematical sum of sub-criteria scores. Thus, a concept paper may be highly rated despite having a low score for one sub-criterion (e.g.,

the concept paper identifies good reasons why a single camera will be used, contrary to criterion #3 sub-criterion 2).

Weighting of Criteria for Concept Papers

| | |
|---|---|
| Criterion 1: Knowledge | 20% |
| Criterion 2: Technical Approach | 40% |
| Criterion 3: Subject Matter | 40% |

# Phase 2: Dataset Submission

## Introduction

During Phase 2 of the challenge, invited contestants will implement their proposals and submit datasets according to the Requirements below. Datasets will consist of images or videos that contain different scenes or different impairments to quality. The datasets will also include a computer vision failure rate for each image or video, and a general description of how the failure rates were derived. During evaluation, the Judging panel will score each submission based on the evaluation criteria.

A Contestant Informational Webinar will be held following the announcement of winners of Phase 1. It is strongly suggested that each contestant invited to participate in Phase 2 attend the informational webinar, currently scheduled for November 3, 2020 (subject to change). Any contestants not able to attend will be provided a recording of the informational webinar.

## Important Dates

Dataset: Launch on November 3, 2020 and datasets due May 4, 2021; NIST will notify winners of Phase 2 by May 19, 2021.

## How to Enter

Invited contestants to Phase 2 will receive an email with information about Phase 2 of the Challenge.

## Submission Requirements

Invited contestants will implement their proposals and submit their final datasets and documentation through a secure FTP site. NIST will provide instructions for the FTP site and templates for contestants to submit their dataset and documentation.

- A set of media files with the following requirements:

- ○ Option #1
  - ■ Minimum of 250+ images
  - ■ Images must be JPEG file format
  - ■ Image resolution must be 4 megapixels or greater
  - ■ Lower resolution images must be justified by specific first responder application (e.g., infrared images)
- ○ Option #2
  - ■ Minimum of 250+ video files
  - ■ Video files must use the .mp4 file format, compressed with H.264 (AVC)
  - ■ Each video must be no more than 5 seconds in duration
  - ■ Videos must be high definition resolution or greater (720 × 1280 pixels minimum), progressive
- ○ Datasets cannot include both images and video
- ○ Naming convention:
  - ■ Establish a short name for the dataset
  - ■ Include the dataset name as a prefix, in each media file's name
  - ■ Choose a meaningful file name convention (please do not just number the media 1 through 250)
- ● A spreadsheet (CSV or .xlsx) that includes:
  - ○ Failure rate data
  - ○ Categorical data to subdivide the images or videos (e.g., by impairment type, impairment severity, scene, camera type, weather, light level, camera position)
- ● A document (Word or PDF) that includes:
  - ○ The team's identity (e.g., team name, team members, university or company)
  - ○ How the images were created
  - ○ How the assessment data was created
  - ○ Explain the chosen failure rate assessment method and why it is appropriate for this application
  - ○ Usage and licensing terms for the images
  - ○ Self-assessment of the assessment technique and lessons learned
  - ○ 20-page limit
- ● [Optional] Supplemental data, if needed

The categorical data is intended to help researchers understand the dataset and divide images into useful subsets. The categories are chosen by the contestant and assigned manually. The example table below includes three columns of data that can be used to subdivide the images, each noting the presence or absence of a single impairment. Multiple category levels may also be used at the discretion of the contestant (e.g., none, low, medium, and high).

Example Table of Categorical Data:

| Image Name | Assessment | Blur Category | Noise Category | Overexposure |
|---|---|---|---|---|

| A.jpg | 0.4 | Yes | No | Yes |
|-------|-----|-----|-----|-----|
| B.jpg | 0.8 | No | Yes | No |
| C.jpg | 0.2 | Yes | No | No |
| D.jpg | 1.0 | No | No | No |

## Evaluation Criteria and Judging

PSCR will initially review submissions for compliance with the objectives and Official Rules of this contest. A submission that fails to meet the compliance criteria will be disqualified and will be ineligible to compete in this contest. Submissions that pass the initial compliance review will be evaluated and scored by the Judging panel.

Datasets will be evaluated based on the following criteria:

### Criterion #1: Compliance Testing (Pass/Fail)

The compliance testing includes:

- 1) The submission packet:
    - A dataset of at least 250 images in JPEG format, or at least 250 videos in MP4 format
    - A document that describes the submission
    - A spreadsheet with failure rate data and category data
- 2) Licensing terms for the images or videos, identified by either the document or the spreadsheet.

### Criterion #2: Dataset Quality (60%)

This criterion assesses the value of the images or videos for developing NR metrics that detect specific impairments.

- Were modern cameras used to create the images or videos? (e.g., no synthetic impairments, quality levels meet consumer expectations from modern cameras)?
- Variety of subject matter (e.g., different people, places, objects, colors, textures, size of objects)
- The images or videos cover a wide range of quality, as perceived by the judges
- The document identifies key information that a researcher may need to understand the image dataset (e.g., list of cameras, file naming convention, image licensing terms)
- The images or videos depict scenes and situations of interest to public safety, such as the difficult environments where first responders operate

For Single Camera Impairment dataset submissions, judges will evaluate:

- Impairment diversity (e.g., how well does the dataset demonstrate a wide range of visual responses associated with the impairment?)
- Impairment realism
- Breadth of impairment severity
- Depiction of false positives (e.g., does the dataset include images that contain similar situations that could be confused for the impairment?)
- To what extent were other impairments avoided? If confounding variables are unavoidable, does the dataset include information that will help users understand the situation and differentiate between the intended impairment and secondary impairments?

For Single Computer Vision Application dataset submissions, judges will evaluate:

- How well does the dataset portray the computer vision scenario?
- How well does the dataset portray the variety of camera impairments that will be encountered when this computer vision algorithm is deployed?
- Diversity of camera position (e.g., high surveillance camera, body-cam height, ceiling pointing down) Note: the scenario may mandate a single camera position
- Variety of weather, lighting, and other environmental factors (e.g., full sun, indoors, dim lighting, night, inclement weather, rising/setting sun, side lighting, back lighting, deep shadows, multiple light sources, spider webs or cobwebs near the lens, dust on lens, restaurant grease splatter on lens, raindrops on lens, fingerprints on lens, small bug on lens, bug splattered on lens of a moving camera)

## Criterion #3: Assessment Data and Documentation (40%)

This criterion assesses the assessment data and the experiment documentation:

- The failure rate data cover a variety of levels (i.e., more than two)
- The failure rate assessment method chosen is appropriate and well documented, with enough information to be understood and replicated
- Viability of the failure assessment method, considering implementation speed, data accuracy, extensibility, likelihood of errors, confounding factors, etc.
- The categories identify subsets of images with interesting and potentially useful traits
- [Single Camera Impairment Dataset submissions only] The spreadsheet includes variable(s) that helps the user understand differences between the images or videos (e.g., impairment severity, impairment subtypes).
- [Single Computer Vision Application submissions only] The spreadsheet includes variable(s) that identify the presence or absence of specific impairments.
- The document includes a quality, thorough self-assessment of the failure rate assessment technique and lessons learned, that considers experiment design, dataset, failure rate assessment method, and lessons learned.
- The submission contributes to the challenge's overall goals, for example, furthering research into similarities and differences of the human visual system and computer vision.
- For consideration of optional "Best in Show" prizes: submission goes above and beyond minimum evaluation criteria to develop and demonstrate a viable method to assess the failure rate

of computer vision applications (note: this criterion will not negatively impact the submission evaluation score)

## Scoring for Datasets

Each phase 2 submission will be scored as follows: Criterion #1 is pass / fail; the submission must pass all sub-criteria. The overall score for criterion #2 will be recorded on a scale of [0 to 60 points] and the overall score for criterion #3 will be recorded on a scale of [0 to 40 points].

The reviewers will also note whether they believe this submission contains an outstanding dataset or outstanding assessment data and documentation. These separate scores will be considered for the best in show prizes, described below.

### Criterion for the Optional Prize: CDVL Distribution Prize (Pass/Fail)

The submissions from the contestants who elect to submit for the optional prize of $12,000 for open sourcing their datasets will be evaluated as follows:

Up to 10 contestants invited to participate in Phase 2 may qualify for an additional prize by granting NIST permission to redistribute the submission package (i.e., images, spreadsheet, and document) on the Consumer Digital Video Library (CDVL, www.cdvl.org) for research and development purposes. The submission must pass Phase 2 Criterion #1 (Compliance Testing) to be eligible. Granting NIST permission to redistribute the submission package on the CDVL includes agreeing to the CDVL licensing terms, which are available at https://cdvl.org/license/.  Eligible contestants will acknowledge that they wish to be considered for this optional prize including granting NIST permission to redistribute the submission package on the CDVL and agreement with the CDVL license by completing the CDVL video posting agreement form. Upon receipt of the signed agreement form and after the conclusion of the challenge, NIST will redistribute each submission package to CDVL.

### Criteria for Optional Prizes: Best in Show (Pass/Fail)

The Judging panel may award one or both of the following optional prizes:

1) Best Assessment Data prize. This optional prize award is for a submission with an outstanding assessment under evaluation criterion #3.
2) Best Dataset prize. This optional award is for a submission with an outstanding assessment under evaluation criterion #2.

The Judging panel will consider and, at its sole discretion, award the Best Assessment Data prize as the first optional prize award at the conclusion of Phase 2. The judging panel will then consider and, at its sole discretion, award the Best Dataset prize, if applicable. The winner of the Best Assessment Data prize, if any, is excluded from consideration for the Best Dataset prize. A single submission cannot win both prizes.

## Weighting of Criteria for Dataset Submission

| Criterion #1: Compliance Testing | N/A |
|---|---|
| Criterion #2: Dataset Quality | 60% |
| Criterion #3: Assessment Data and Documentation | 40% |

# General Submission Requirements for All Phases

In order for submissions to be eligible for review, recognition and award, contestants must meet the following requirements:

- Deadline - The submission must be available for evaluation by the end date noted in the "Important Dates" section of these rules.
- No NIST logo - submission(s) must not use NIST's logo or official seal and must not claim NIST endorsement.
- Each submission must be original, the work of the contestant, and must not infringe, misappropriate or otherwise violate any intellectual property rights, privacy rights, or any other rights of any person or entity.
- It is an express condition of submission and eligibility that each contestant warrants and represents that the contestant's submission is solely owned by the contestant, that the submission is wholly original with the contestant, and that no other party has any ownership rights or ownership interest in the submission. The contestant must disclose if they are subject to any obligation to assign intellectual property rights to parties other than the contestant, if the contestant is licensing or, through any other legal instrument, utilizing intellectual property of another party.
- Each contestant further represents and warrants to NIST that the submission, and any use thereof by NIST shall not: (i) be defamatory or libelous in any manner toward any person, (ii) constitute or result in any misappropriation or other violation of any person's publicity rights or right of privacy, or (iii) infringe, misappropriate or otherwise violate any intellectual property rights, privacy rights or any other rights of any person or entity.
- Each submission must be in English.
- Submissions will not be accepted if they contain any matter that, in the sole discretion of NIST, is indecent, obscene, defamatory, libelous, in bad taste, or demonstrates a lack of respect for public morals or conduct, promotes discrimination in any form, or which adversely affects the reputation of NIST. NIST shall have the right to remove any content from the Event Website in its sole discretion at any time and for any reason, including, but not limited to, any online comment or posting related to the Challenge.

- If NIST, in its discretion, finds any submission to be unacceptable, then such submission shall be deemed disqualified.

# Judging Panel

The submissions will be judged by a qualified panel of expert(s) selected by the Director of NIST. The panel consists of Department of Commerce, National Institute of Standards and Technology and non-Department of Commerce, National Institute of Standards and Technology experts who will judge the submissions according to the judging criteria identified above in order to select winners. Judges will not (A) have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered contestant in a contest; or (B) have a familial or financial relationship with an individual who is a registered contestant.

The decisions of the Judging panel for the contest will be announced in accordance with the dates noted in the "Important Dates" section of these rules. NIST PSCR will not make contestants' evaluation results from the Judging panel available to contestants or the public.

# Verification of Winners

ALL CONTEST WINNERS WILL BE SUBJECT TO VERIFICATION OF IDENTITY, QUALIFICATIONS AND ROLE IN THE CREATION OF THE SUBMISSION BY THE DEPARTMENT OF COMMERCE, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.

Contestants must comply with all terms and conditions of the Official Rules. Winning a prize is contingent upon fulfilling all requirements contained herein. The potential winners will be notified by email, telephone, or mail after the date of announcement of winning results. Each potential winner of a monetary or non-monetary award will be required to sign and return to the Department of Commerce, National Institute of Standards and Technology, within ten (10) calendar days of the date the notice is sent, an ACH Vendor/Miscellaneous Enrollment Form (OMB NO. 1510-0056) and a Contestant Eligibility Verification in order to claim the prize.

In the sole discretion of the Department of Commerce, National Institute of Standards and Technology, a potential winner will be deemed ineligible to win if: (i) the person/entity cannot be contacted; (ii) the person/entity fails to sign and return an ACH Vendor/Miscellaneous Enrollment Form (OMB NO. 1510-0056) and a Contestant Eligibility Verification within the required time period; (iii) the prize or prize notification is returned as undeliverable; or (iv) the submission or person/entity is disqualified for any other reason. In the event that a potential or announced winner is found to be ineligible or is disqualified for any reason, the Department of Commerce, National Institute of Standards and Technology, in their sole discretion, may award the applicable prize to another contestant.

# Eligibility Requirements:

A contestant (whether an individual, team, or legal entity) must have registered to participate and complied with all of the requirements under section 3719 of title 15, United States Code as contained herein. At the time of entry, the Official Representative (individual or team lead, in the case of a group project) must be age 18 or older and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business shall be incorporated in and maintain a place of business in the United States or its territories.

Contestants may not be a Federal entity or Federal employee acting within the scope of their employment. Employees and contractors of the Challenge Partners (as identified on the Challenge website) are not eligible to enter. Any other individuals or legal entities involved with the design, production, execution, distribution or evaluation of the Challenge are not eligible to enter. Former NIST PSCR Federal employees or Associates are not eligible to compete in a prize challenge within one year from their exit date. NIST Associates are eligible to enter but may not utilize NIST funding for competing in this challenge, nor are they eligible to receive a cash prize award. Individuals currently receiving PSCR funding through a grant or cooperative agreement are eligible to compete but may not utilize the previous NIST funding for competing in this challenge. Previous and current PSCR prize challenge contestants are eligible to compete. Non-NIST Federal employees acting in their personal capacities should consult with their respective agency ethics officials to determine whether their participation in this competition is permissible. A contestant shall not be deemed ineligible because the contestant consulted with Federal employees or used Federal facilities in preparing its entry to the Challenge if the Federal employees and facilities are made available to all contestants on an equitable basis.

Contestants, including individuals and private entities, must not have been convicted of a felony criminal violation under any Federal law within the preceding 24 months and must not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. Contestants must not be suspended, debarred, or otherwise excluded from doing business with the Federal Government.

Multiple individuals and/or legal entities may collaborate as a group to submit a single entry and a single individual from the group must be designated as an Official Representative for each entry. That designated individual will be responsible for meeting all entry and evaluation requirements.

## Teams

Contest submissions can be from an individual or a team. Individuals or members of a team may only be selected to participate on one contestant group and cannot participate on multiple teams nor contestant categories. If a team of individuals, a corporation, or an organization is selected as a prize winner, NIST will award a single dollar amount to the Official Representative. The Official Representative is solely responsible for allocating any prize amount among its member contestants as they deem appropriate. NIST will not arbitrate, intervene, advise on, or resolve any matters between entrant members. It will be up to the winning team(s) to reallocate the prize money among its member contestants, if they deem it appropriate.

## Submission Rights

Any applicable intellectual property rights to a submission will remain with the contestant. By participating in the prize challenge, the contestant is not granting any rights in any patents, pending patent applications, or copyrights related to the technology described in the entry. However, by submitting a contest submission, the contestant is granting the Department of Commerce, National Institute of Standards and Technology certain limited rights as set forth herein.

- The contestant grants to the Department of Commerce, National Institute of Standards and Technology the right to review the submission, to describe the submission in any materials created in connection with this competition, and to screen and evaluate the submission. The Department of Commerce, National Institute of Standards and Technology will also have the right to publicize contestant's name and, as applicable, the names of contestant's team members and/or organizations which participated in the submission following the conclusion of the competition.
- As part of its submission, the contestant must provide written consent granting the Department of Commerce, National Institute of Standards and Technology, a royalty-free, non-exclusive, irrevocable, worldwide license to display publicly and use for promotional purposes the contestant's entry ("demonstration license"). This demonstration license includes posting or linking to the contestant's entry on the Department of Commerce, National Institute of Standards and Technology websites, including the competition website and inclusion of the contestant's submission in any other media, worldwide.

## Warranties

By submitting an entry, each contestant represents and warrants that the contestant is the sole author and copyright owner of the submission; that the submission is an original work of the contestant and that the contestant has acquired sufficient rights to use and to authorize others, including the Department of Commerce, National Institute of Standards and Technology, to use the submission, as specified throughout the Official Rules, that the submission does not infringe upon any copyright or upon any other third party rights of which the contestant is aware; and that the submission is free of malware.

By submitting an entry, the contestant represents and warrants that all information submitted is true and complete to the best of the contestant's knowledge, that the contestant has the right and authority to submit the entry on the contestant's own behalf or on behalf of the persons and entities that the contestant specifies within the entry, and that the entry (both the information and materials submitted in the entry and the underlying technology/method/idea/treatment protocol/solution described in the entry):

- is the contestant's own original work, or is submitted by permission with full and proper credit given within the entry;
- does not contain proprietary or confidential information or trade secrets (the contestant's or anyone else's);
- does not knowingly violate or infringe upon the patent rights, industrial design rights, copyrights, trademarks, rights of privacy, publicity or other intellectual property or other rights of any person or entity;
- does not contain malicious code, such as viruses, malware, timebombs, cancelbots, worms, Trojan horses or other potentially harmful programs or other material or information;

- does not and will not violate any applicable law, statute, ordinance, rule or regulation, including, without limitation, United States export laws and regulations, including but not limited to, the International Traffic in Arms Regulations and the Department of Commerce Export Regulations; and
- does not trigger any reporting or royalty or other obligation to any third party.

By making a submission to this prize competition, each contestant agrees that no part of its submission includes any Trade Secret information, ideas or products, including but not limited to information, ideas or products within the scope of the Trade Secrets Act, 18 U.S.C. § 1905. All submissions to this prize competition are deemed non-proprietary. Since NIST does not wish to receive or hold any submitted materials "in confidence" it is agreed that, with respect to the contestant's entry, no confidential or fiduciary relationship or obligation of secrecy is established between NIST and the contestant, the contestant's team, or the company or institution the contestant represents when submitting an entry, or any other person or entity associated with any part of the contestant's entry.

## Additional Terms and Conditions

This document outlines the Official Rules for the Enhancing Computer Vision for Public Safety Challenge. Nothing within this document or in any documents supporting the Enhancing Computer Vision for Public Safety Challenge shall be construed as obligating the Department of Commerce, NIST or any other Federal agency or instrumentality to any expenditure of appropriated funds, or any obligation or expenditure of funds in excess of or in advance of available appropriations.

## Contest Subject to Applicable Law

All contests are subject to all applicable federal laws and regulations. Participation constitutes each contestant's full and unconditional agreement to these Official Rules and administrative decisions, which are final and binding in all matters related to the contest. Eligibility for a prize award is contingent upon fulfilling all requirements set forth herein. This notice is not an obligation of funds; the final award of prizes is contingent upon the availability of appropriations.

Participation is subject to all U.S. federal, state and local laws and regulations. Contestants are responsible for checking applicable laws and regulations in their jurisdiction(s) before participating in the prize competition to ensure that their participation is legal. The Department of Commerce, National Institute of Standards and Technology shall not, by virtue of conducting this prize competition, be responsible for compliance by contestants in the prize competition with Federal Law including licensing, export control, and nonproliferation laws, and related regulations. Individuals entering on behalf of or representing a company, institution or other legal entity are responsible for confirming that their entry does not violate any policies of that company, institution or legal entity.

## Resolution of Disputes

The Department of Commerce, National Institute of Standards and Technology is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

In the event of a dispute as to any registration, the authorized account holder of the email address used to register will be deemed to be the contestant. The "authorized account holder" is the natural person or legal entity assigned an email address by an Internet access provider, online service provider or other organization responsible for assigning email addresses for the domain associated with the submitted address. Contestants and potential winners may be required to show proof of being the authorized account holder.

## Publicity

The winners of these prizes (collectively, "Winners") will be featured on the Department of Commerce, National Institute of Standards and Technology website, newsletters, social media, and other outreach materials.

Except where prohibited, participation in the contest constitutes each winner's consent to the Department of Commerce, National Institute of Standards and Technology's and its agents' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media, worldwide, without further permission, payment or consideration.

## Payments

The prize competition winners will be paid prizes directly from the Department of Commerce, National Institute of Standards and Technology. Prior to payment, winners will be required to verify eligibility. The verification process with the agency includes providing the full legal name, tax identification number or social security number, routing number and banking account to which the prize money can be deposited directly.

All cash prizes awarded to contestants by the Department of Commerce, National Institute of Standards and Technology are subject to tax liabilities, and no withholding will be assessed by the Department of Commerce National Institute of Standards and Technology on behalf of the contestant claiming a cash prize.

## Liability and Insurance

Any and all information provided by or obtained from the Federal Government is without any warranty or representation whatsoever, including but not limited to its suitability for any particular purpose. Upon registration, all contestants agree to assume and, thereby, have assumed any and all risks of injury or loss in connection with or in any way arising from participation in this contest, development of any application or the use of any application by the contestants or any third-party. Upon registration, except in the case of willful misconduct, all contestants agree to and, thereby, do waive and release any and all claims or causes of action against the Federal Government and its officers, employees and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential and whether foreseeable or not), arising from their participation in the contest, whether the claim or cause of action arises under contract or tort. Upon registration, all contestants agree to and, thereby, shall indemnify and hold harmless the Federal Government and its

officers, employees and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential and whether foreseeable or not), including but not limited to any damage that may result from a virus, malware, etc., to Government computer systems or data, or to the systems or data of end-users of the software and/or application(s) which results, in whole or in part, from the fault, negligence, or wrongful act or omission of the contestants or contestants' officers, employees or agents.

Contestants are not required to obtain liability insurance for this Competition.

## Records Retention and FOIA

All materials submitted to the Department of Commerce, National Institute of Standards and Technology as part of a submission become official records and cannot be returned. Any confidential commercial information contained in a submission should be designated at the time of submission. Submitters will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26.

## 508 Compliance

Contestants should keep in mind that the Department of Commerce, National Institute of Standards and Technology considers universal accessibility to information a priority for all individuals, including individuals with disabilities. In this regard, the Department is strongly committed to meeting its compliance obligations under Section 508 of the Rehabilitation Act of 1973, as amended, to ensure the accessibility of its programs and activities to individuals with disabilities. This obligation includes acquiring accessible electronic and information technology. When evaluating submissions for this contest, the extent to which a submission complies with the requirements for accessible technology required by Section 508 will be considered.

## General Conditions

This prize competition shall be performed in accordance with the America COMPETES Reauthorization Act of 2010, Pub. Law 111-358, title I, § 105(a), Jan. 4, 2011, codified at 15 U.S.C. § 3719 and amended by the American Innovation and Competitiveness Act of 2016 (Pub. L. No. 114-329) (hereinafter "America COMPETES Act").

The Department of Commerce, National Institute of Standards and Technology reserves the right to cancel, suspend, and/or modify the contest, or any part of it, if any fraud, technical failures, or any other factor beyond the Department of Commerce, National Institute of Standards and Technology's reasonable control impairs the integrity or proper functioning of the contest, as determined by the Department of Commerce, National Institute of Standards and Technology in its sole discretion. The Department of Commerce, National Institute of Standards and Technology is not responsible for, nor is it required to count, incomplete, late, misdirected, damaged, unlawful, or illicit votes, including those secured through payment or achieved through automated means.

ALL DECISIONS BY The Department of Commerce, National Institute of Standards and Technology ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST.