2025 Signal Processing Cup

[The DFWild-Cup: Deepfake Face Detection In The Wild Competition]

Official Document of the 2025 Signal Processing Cup

Version 1.0 *Last updated July 11, 2024*

1. Introduction

With the surge in advancements in synthetic data generation, deepfakes pose a serious threat due to their potential application in unethical and malicious purposes. This encompasses manipulating public opinion, instigating geopolitical tension, defamation, and identity threats. This year marks a significant election season globally, with more voters than ever in history expected to head to the polls across at least 64 countries. Naturally, deepfakes are of greater concern, as the generated contents in the form of image, video and audio are already widely circulated to gain political advantages. Addressing deepfakes is increasingly challenging due to the continuous development of new generation techniques, creating an 'arms race' between the attacker and the defender, as also mentioned in a recent BBC news report.

Of all potential deepfake content, fake images are more prevalent, as they can be easily generated by non-experts using publicly available tools that require minimal domain knowledge. In recent years, several solutions are proposed to discriminate the fake content from real. However, their effectiveness is questionable due to a lack of generalization, especially in the presence of unseen attacks not represented in the training data. To address this challenge, we present the *Deepfake Face Detection In The Wild Competition* (DFWild-Cup), which focuses on automatically detecting image deepfakes in real-world settings, with participants assigned to develop systems capable of distinguishing between real and computer-generated images. This DFWild-Cup competition specifically emphasizes the generalization aspects of deepfake detectors by encompassing a wide variety of data generated using diverse generation methods, attack scenarios and source datasets. While a few other machine learning challenges already addressed the deepfake detection, this represents the inaugural challenge solely focused on image deepfake detection in the wild, highlighting its emphasis on diversity, particularly in real-world scenarios.

In DFWild-Cup, our focus will be on facial images as they are central to deepfake misuse. While research on detecting deepfakes encompasses different image types facial images make this problem particularly significant. While deepfake videos are also a significant concern, detecting deepfake images can be regarded as a simplified general scenario, focusing on individual frames extracted from videos. Facial deepfake images can be classified into several types depending on the attack models, such as *face reenactment*, *face swapping* or *face replacement*, and *face synthesis*. In face reenactment, the source face image characteristics are used for a target face image. In face swapping deepfakes typically involve manipulating the appearance of a known individual, often placing them in unexpected situations. The face synthesis entails generating entirely fictitious facial images, sometimes of individuals who do not exist. Even non-experts can use several publicly available tools to create such images.

Our initiative towards this competition has started with using a curated list of publicly available real and fake facial image datasets that allow for data reuse under the appropriate licenses. These datasets are predominantly utilized in research articles published in top-tier journals and conferences. In this competition, we will utilize a subset of the listed datasets to construct the training and development sets. Conversely, the test set will be prepared from additional datasets in the list. Participants will not be provided with the names of the datasets used in the test. Additionally, we will include newly generated images in the test set with diverse sources, encompassing different age groups, nationalities, professions, and ethnic backgrounds. This will ensure the generalization ability of the deepfake detectors to real-world scenarios, also referred to as ``in the wild''.

2. Competition Details

2.1 Task Description

  The DFWild-Cup is concerned with identifying images whether they are *real* or *fake*. The real image can be natural image collected with a camera or snapshots of real videos. Whereas the fake images may be generated with image various image synthesis or forgery techniques or can be snapshot of computer-generated fake videos. The participant will be provided with a set of training and test data. After training the detector with the dedicated training data, the task is to estimate a score of each of the test images. A higher score indicates a real image whereas a lower score indicates a fake image.

2.2 Dataset Description

In this challenge, we provide a collection of publicly available datasets created for the DeepfakeBench evaluation. This includes eight different standard datasets named as *Celeb-DF-v1*, *Celeb-DF-v2*, *FaceForensics++*, *DeepfakeDetection*, *FaceShifter*, *UADFV*, *Deepfake Detection Challenge Preview*, and *Deepfake Detection Challenge*. The datasets are pre-processed identically to avoid the dependency of the detector on the adopted pre-processing method. Even though the datasets used for the challenged are created from the publicly available datasets, the file names are anonymized and any indicator that may reveal the source dataset name is removed. In addition to the existing standard datasets, the test dataset may contain samples from newly generated dataset. This is purposefully made to assess the generalization ability of the submitted systems.

2.3 License

This audio database is made available under the terms of the Creative Commons Attribution-NonCommercial 4.0 International Public License (identified as CC BY-NC-4.0 in SPDX). This means that you are free to share (copy, distribute, and transmit the work) and remix (adapt the work), as long as you credit the original authors, do not use this work for commercial purposes, and share any derivative works under a similar license. For more information, please visit the Creative Commons website (https://creativecommons.org/licenses/by-nc-sa/4.0/).

2.4 Evaluation Protocols

In the DFWild-Cup, a specific training set consisting of real and fake images from multiple datasets is provided. The participants are required to train their systems with the given training list only. If the participants decide to use a subset of the training list, the selection process must be justified. A validation set that includes ground-truth (also known as development set) will be provided to the participants for parameter tuning and hyper-parameter optimization. The participant will have access to both lists as well as the image files immediately after their registration is confirmed. The participants will have access to the final test data (also known as evaluation set) for which they need to submit the final scores for challenge evaluation and ranking.

3. Evaluation Metrics

The present deepfake detection research adopts various metrics, such as AUC, accuracy, F1-score, precision, and recall, and equal error rate (EER). In the DFWild-Cup, we will adopt traditional metrics as well \emph{detection cost function} (DCF) which is widely used for evaluating biometric systems.

4. Participants submissions

4.1 Results

We provided a scoring tool for internal evaluation of validation set. The participants should make one valid submission for the challenge task. A valid submission should contain scores for all files. A submission with missed score will not be considered.

The format of a submission is as follows:

fileID <TAB> score

where *fileID* is the id of the test file, and score is a numerical value -- a higher value for real images and lower value for fake images.

A sample of the result file is shown here:
```
file1    0.951214
file2    0.231245

file3    0.872451
```

file4   0.012454

❗ Note: All the files in the evaluation set may not be scored and the challenge organizers may purposefully ignore some files for final scoring. However, the participants must submit scores for all the files.

4.2 Technical Report

Each participating team should submit a technical report that includes:

- How the data is used.

- Which model(s) are used and the corresponding model parameters.

- How the models are trained (i.e., loss function, optimizer, learning rate, batch size, stopping criteria, etc.)

- The description of the pre-trained models (if the participants have used any publicly available pre-trained models for embedding extraction).

- Number of model parameters (trainable and non-trainable).

- Time (secs) required to process one test file.

- Performance on the validation set.

❗ The technical report is obligatory for introducing the winners. The technical report must be submitted along with the evaluation set scores.

5. SPS Competition Terms & Conditions

5.1 Team Eligibility

Full details of team eligibility is available in the Terms and Conditions document available on the SPS website.

5.1.a. Team Composition

➢ Each team <u>MUST</u> be composed of: (i) One faculty member (the Supervisor) and (ii) At least 3 but no more than 10 undergraduates; *Optionally* (iii) At most one graduate student (the Tutor).
  - At least three of the undergraduate team members must be SPS student members at time of team registration.
➢ Further definitions of each team position are as follows:
  - Faculty (Supervisor): Postdocs and research associates are not considered as faculty members.
  - Graduate Student (Tutor): A graduate student is a student having earned at least a 4-year University degree at the time of submission. *Please note: Tutors are not eligible to receive travel grants or prize money.*
  - Undergraduate: An undergraduate student is a student without a 4-year degree.
➢ Team members cannot be changed after the team registration deadline.
➢ At least one undergraduate team member must be in attendance (in-person) of the final round of the competition held at the 2025 International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2025) to present the team's work.**
➢ Students receiving the travel grant and prize payments <u>MUST</u> be active SPS members at time of team formation. Signal Processing Society membership can be added here.

*Important notice: Upon registering a team for the competition, the team must commit to at least one undergraduate team member representing the team by attending the physical competition and participating in the final round of the competition at the physical conference. Should a team not be able to participate physically (in-person) in the final round of the competition held at the respective conference (ICASSP 2025) for any reason, at any point in the competition, then the team must notify SPS Staff and organizers immediately. This will likely result in the team being ineligible to continue in the competition, therefore forfeiting their position in the competition. Teams must make every effort to attend the final round at the conference; visa issues *may* be an exception*. If all team members are unable to obtain visas, please be prepared to present proof of visa process, communication to obtain visa, as well as a visa denial. All eligibility decisions are at the discretion of the SPS Student Services Committee and competition organizers*.

Should a team be disqualified or forfeit their finalist position for any reason, the next team selected by the organizers may be contacted to compete in the final round, following the same guidelines as above.

5.1.b Team ineligibility (Further clarification)

Specific team **ineligibility** in addition to the above. *Any of these criteria will result in the team being disqualified/ineligible to continue in the competition:*

➢ Teams that are composed with 50% or more of its members being students who have previously participated on a finalist team of another SPS competition within the last calendar year are not eligible.
➢ Teams with the exact same member composition of a previously placed team in the top 3 of another SPS competition within the last calendar year are not eligible.
➢ Any team members who have placed in the top three teams of any SPS competition held during the previous conference, i.e. a member from one of the 3 finalist teams of the 2024 SP Cup or 5-MICC (at ICASSP) will not be eligible to participate in the 2024 VIP Cup or 5-MICC (at ICIP).
➢ Team members cannot simultaneously participate in more than one competition at the same time.
➢ Team members cannot participate on more than one team at the same time.

5.2 Final Round Judging Criteria for SPS Competitions

The judging for the final phase of the competition held live at the conference will be based on six equally weighted criteria. Each of the three finalist teams will be scored on the six criteria and the team with the highest score will place 1st, the team with the second highest score will place 2nd, and the team with the third highest score will place 3rd in the competition.

The six criteria are:

1. Innovation of the proposed approach & thoroughness of experiments
2. Performance on the validation set
3. Performance on the test set
4. Model and time complexity
5. Quality and clarity of the final report
6. Quality and clarity of the presentation

The final winning rankings will be based on the weighted points awarded from the six criteria during judge deliberations at the end of the competition. Final rankings are ultimately decided by the judges, at their discretion.

5.3 Judge Participation & Conflict of Interest Final Round Judging Criteria for SPS Competitions

Any judge or team supervisor participating in the competition must sign a Conflict-of-Interest Form agreeing to the following key points. Full information is on the Conflict-of-Interest Form.

Conflict of Interest concerns shall be disclosed and addressed in accordance with IEEE Policies 9.9 A, B. and C and IEEE Policy 4.4.H. - Eligibility and Process Limitations. Judges involved at any stage of the team rankings/scoring process for an SP competition shall be ineligible to judge/vote on the outcome of team rankings for the competition in which the conflict exists. Any real and perceived conflict of interest shall be avoided. Conflict of interest shall be defined as any relationships, professional or otherwise, that can affect impartiality and objectivity. Such relationships include, but are not limited to the below list. This list also applies

   a. faculty supervisor/student,
   b. faculty supervisor/post-doc,
   c. manager/employee,
   d. shared institutional affiliations,
   e. recent (less than five years) research collaborations or joint authorship,
   f. judge/team supervisor
   g. In the case of a conflict of interest, the judge should neither listen to nor speak in the discussion and should not vote on the team scoring/ranking process.

In our SPS Policies and Procedures (https://signalprocessingsociety.org/volunteers/policy-and-procedures-manual)

The IEEE Conflict of Interest form must be completed before participating in the competition. The Conflict of Interest form can be completed at the following link: **https://www.ieee.org/about/compliance/conflict-of-interest/coiandpob.html**

Conflict Resolution Process

The Society leadership will create an ad hoc committee to handle each matter requiring conflict resolution.

1. **Composition.** The composition of each ad hoc committee will include area experts. The experts should be chosen based on mediation experience or subject area experience. All members of the ad hoc committee should be non-conflicted, e.g., no prior involvement in the situation, no collegial work relationship, etc. The committee may be augmented with the agreement of all members of the ad hoc committee. The committee will select its own chair.

2. **Process.** During the first meeting of the ad hoc committee, the committee shall create a timeline detailing the conflict resolution process, as well as determine any operational rules for the ad hoc committee's operation (e.g., length of final report; length of statement of dissent, etc.) The individual who brought the conflict matter forward shall be informed of the timeline. All discussions and information presented to the ad hoc committee shall be handled in a confidential manner.

Decisions need not be unanimous; final outcomes may be determined by majority vote of the membership of the ad hoc committee. Dissenting members may include their dissenting opinion as part of the report; the length of such dissent will be determined as part of the committee's operational rules.

After the ad hoc committee has determined its final ruling, the ad hoc committee chair shall be responsible for preparing a short report documenting the committee's findings. The report shall be provided to the individual who brought the conflict matter forward.

3. **Appeal.** If the individual who brought the conflict matter forward feels that the matter has not been adequately resolved by the ad hoc committee at the Society level, the individual may escalate the matter further to TAB or IEEE. The ad hoc committee report shall be shared with TAB and/or IEEE.

5.4 Prizes for Finalists

The [eligible] three teams with the highest performance in the open competition based on the judging criteria will be selected as finalists and invited to participate in the final competition at ICASSP or ICIP. The champion team will

receive a Grand Prize of $5,000. The first and the second runner-up teams will receive a prize of $2,500 and $1,500, respectively, in addition to travel grants and complimentary conference registrations for <u>up to three team members</u>.

➢ Up to three undergraduate student members from each finalist team will be provided travel support to attend the conference in-person. In-person attendance of the physical conference is required for reimbursement.

- o Travel grant funds are offered on a reimbursement basis of up to $1,200 for continental travel and $1,700 for intercontinental travel. *There are no exceptions*.
- o Funds will be issued by way of a bank transfer after the competition, via Concur.
- o Receipts for reimbursement must be uploaded into Concur
  - ▪ Prior to claiming your travel grant award, you must submit receipts of your travel expenses that are equal to or exceed the grant amount in order to receive the full travel grant payment. Travel expenses include: air fare, train tickets, hotel, visa fees, transit, meals, and conference registration. Receipts are required for <u>all items</u> and must equal to or exceed the total reimbursement amount. **The receipts must show** form of payment used, name, date, and amount paid. Hotel reservation confirmations or bookings, invoices, or quotes for airfare are not acceptable receipts unless the proof of payment is also provided with the document.
  - ▪ All travel expenses must be submitted through IEEE's NextGen Expense Reimbursement (Concur) tool. <u>Detailed instructions will be shared with the (up to) 3 undergraduate members receiving travel support as part of one of the finalist teams.</u>

➢ Complimentary conference registration for <u>up to three undergraduate team members</u> from each finalist team.

- o These complimentary conference registrations cannot be used to cover any papers accepted by the conference.
- o The Tutor and Supervisor are not eligible to receive complimentary registrations.
- o You must notify Jaqueline Rash, Jaqueline.rash@ieee.org, via email of the three undergraduate team members who have been chosen to receive complimentary registration.
- o **VISA information:** Once registered for the conference, each individual will have the opportunity to request an invitation letter <u>through the conference website</u> to be used for the visa application process. This is the only way to receive a letter for visa purposes.

➢ The finalist teams will also be invited to join the Conference Banquet and the SPS Student Job Fair, so that they can meet and talk to SPS leaders and global experts. Please note registration for the Conference Banquet and Student Job Fair is limited and based on availability. <u>You must add this event to your registration</u>. If you are unable to add these events, then maximum capacity has been reached. *There may be additional availability for the Student Job Fair, but not the Conference Banquet. You can inquire by emailing Jaqueline.Rash@ieee.org.*

6. Important Dates

• Challenge announcement/Registration starts: 11 July 2024

• Release of training and validation set: 22 July 2024 ([Access training and validation set HERE](#))

• Team Registration Deadline: 30 September 2024 ([Register your team HERE](#))

• Release of evaluation set: 15 December 2024

• Final submission due: 15 January 2025 ([Submit your work here](#))

• Finalists announcement: 31 January 2025

• Presentation of final results at ICASSP 2025: April 6-11, 2025

7. Competition Registration and Important Resources

7.1 Official SP Cup Team Registration

<mark>All teams must be registered through the official competition in order to be considered as a participating team.</mark> Teams also MUST acknowledge, agree to the SPS Student Terms and Conditions, and meet all eligibility requirements at the time of team registration as well as throughout the competition. Official team registration can be submitted via: 2025 SP Cup Team Registration

7.2 Request Complimentary MATLAB

MathWorks, Inc. continues to support the IEEE SP Cup. Participating students are encouraged to download the complimentary MATLAB Software for use in the competition at the MathWorks' SP Cup webpage: https://ww2.mathworks.cn/academia/student-competitions/sp-cup.html

Please click "Request Software" on the website, fill in the application form, and then submit the form. You will receive an email within 3-5 working days after submission. The email will inform you of the software download, installation, and activation steps if the request is approved.

 ** More technical resources such as videos, examples and documentations can be found at the MathWorks' SP Cup webpage.

7.3 Resource Links

- ➤ SP and VIP Cup Terms & Conditions: Located on both SP Cup and VIP Cup pages of SPS website
- ➤ (Conflict of Interest) SPS Policies and Procedures
- ➤ IEEE Conflict of Interest form: **https://www.ieee.org/about/compliance/conflict-of-interest/coiandpob.html**

8. Contacts

Competition Organizers (technical, competition-specific inquiries):
Md Sahidullah
Email: md.sahidullah@tcgcrest.org

SPS Staff (Terms & Conditions, Travel Grants, Prizes):
Jaqueline Rash, SPS Membership Program and Events Administrator
Email: Jaqueline.Rash@ieee.org

SPS Student Services Committee
Angshul Majumdar, Chair
Email: angshul@iiitd.ac.in

IEEE Signal Processing Society
Signalprocessingsociety.org

IEEE

9. Competition Organizers

Competition Organizers:

Md Sahidullah, India

Ajinkya Kulkarni, Switzerland

Nauman Dawalatabad, USA

Ville Hautamäki, Finland

Tomi Kinnunen, Finland

Junichi Yamagishi, Japan

Sponsor

We gratefully acknowledge MathWorks, Inc. for their continued support of IEEE Signal Processing Cup. Participating students are encouraged to download the complimentary MathWorks Student Competitions Software for use in the competition.

Please note, any work submitted during this competition may be made available to MathWorks for commercial use.