AI CUP 2025 Fall Competition -Computed Tomography Myocardium Image Segmentation II - Aortic Valve Object Detection

Competition Description

This competition aims to perform segmentation of myocardium (cardiac muscle) from computed tomography (CT) images, with two main segmentation targets: the entire cardiac muscle and the aortic valve. By using deep learning methods to train models, the predicted segmentation results can significantly reduce the manpower required for manual annotation. Hypertrophic cardiomyopathy can be alleviated by surgically removing excess myocardial tissue, thus reducing symptoms. The aortic valve plays a critical role in enabling the heart to pump blood effectively to the body's organs. Transcatheter Aortic Valve Replacement (TAVR) is a procedure used to treat aortic valve stenosis, and accurate valve localization through medical imaging is essential for the success of the operation. To this end, we are organizing a competition on CT-based cardiac muscle segmentation and aortic valve object detection. Through highly accurate image segmentation techniques, the resulting cardiac muscle segmentation can be used to construct patient-specific heart models, enabling doctors to conduct preoperative planning and simulations, thereby reducing potential risks during surgery.

Registration Guidelines

1. Currently enrolled students with Republic of China (Taiwan) academic status (including university students, graduate students, and other students) as well as other members of the public (including domestic and international individuals) who are at least 18 years old may register to participate. Minors under 18 years of age may register with the consent of their legal guardian. (Trend Micro employees are excluded).
2. Student participants must register a supervising teacher from their school in the registration system; if there are more than two supervising teachers, please contact the project office.
3. Teams may consist of 1 to 5 people.
4. Participants can only join one team and cannot switch teams once joined.
5. After the registration deadline, team member lists and numbers cannot be changed.
6. During the competition, teams cannot merge or split.

7. Participants joining the competition as part of school course requirements should fill in the course code in the registration system and follow the team formation requirements of that course for grading purposes. All team names will be assigned by the system.

Registration Method

1. Each team member must complete the registration process using the same Google or Facebook account on both "T-Brain AI Battle Arena" (https://tbrain.trendmicro.com.tw/) and "AI CUP Registration System" (https://go.aicup.tw/). The team leader can use the provided link to add each team member to the team.
2. Each team member must log in to the "AI CUP Registration System" (https://go.aicup.tw/) to register, fill in all required information for each team member, and complete the team formation process to register for the competition. All team names will be assigned by the system and cannot be determined by participants. Registration system process instructions can be found on the AI CUP official website (https://www.aicup.tw/) (Related Websites → AI CUP Registration System Process) or by downloading the registration process documentation from the download section. For team member information, please fill in the Email that each team member used to register on the "TBrain AI Battle Arena." If the Email filled in on the registration page does not match the Email used for "T-Brain AI Battle Arena," the registration will be considered unsuccessful.
3. The day after a team completes registration in the "AI CUP Registration System," team members can participate in the competition on the "T-Brain AI Battle Arena."
4. Competition categories include Student Group and General Public Group. For the Student Group, all team members must have student status; if even one team member is not a student, the entire team will be classified in the General Public Group.
5. After registration, please assist by completing the "Cardiac Muscle Segmentation from CT Images Competition II" Pre-test questionnaire URL
6. After the competition, please assist by completing the "Cardiac Muscle Segmentation from CT Images Competition II" Post-test questionnaire URL
7. If participants are registering for the competition as part of a course requirement, please ask the course instructor or teaching assistant for the "Course Code" and fill it in during registration to facilitate instructors accessing competition results for grading purposes.

Award Eligibility and Collection Methods

1. This competition includes 14 "Student Group Ranking Awards" and 2 "Trend Micro AI Talent Cultivation Awards."
2. Student Group Ranking Awards (If any of the top 14 teams include non-student (professional) teams, the Student Group Ranking Award positions will be filled sequentially by ranking, with the next eligible student teams receiving the Ministry of Education certificates and prize money.): Winning teams must agree to the following arrangements from the organizer, otherwise they will forfeit their eligibility to receive awards.
    - All team members must be enrolled students at various levels of educational institutions in the Republic of China from the registration date until the competition test set answer upload deadline. Only teams meeting this requirement are eligible for student group awards, and relevant documentation must be provided at the time of award presentation.
    - Prize money will be distributed via New Taiwan Dollar bank transfer. Qualifying winning teams must designate a team member with a local NTD bank account to receive the prize money. This team member will be responsible for income tax reporting to the Republic of China tax authorities and must sign all required documents including tax forms, personal information usage agreements, and receipts.
    - "Student Group Ranking Award" winning teams must submit reproducible original code and a final report by the specified deadline to verify their results.
    - The final score evaluation includes two parts: (1) The team's ranking on the Private Leaderboard, accounting for 80% of the total score; and (2) The report submitted by the team before the announced deadline, accounting for 20%. Both are actual award criteria. However, winning teams must rank in the top 25% of the Private Leaderboard and score above the baseline set by the judging committee (not exceeding 30 teams), submit their report by the deadline, and pass the review by the judging committee.
    - Reports must include content items specified by the organizer. Evaluation standards include three parts: (1) Report completeness (8%), (2) Report accuracy (8%), and (3) Program originality (4%). Scoring will be conducted by a judging panel of experts from the Ministry of Education's AI Competition and Annotation Data Collection Project Office. Missing or late reports will not be accepted for submission, modification, or evaluation.

- If any member of a "Student Group Ranking Award" winning team has previously won top three places (including 1st-3rd place, gold/silver/bronze medals) three or more times in the "Ministry of Education National College AI Competition (AI CUP)" organized by the Ministry of Education's AI Competition Office, and wins again in this competition, that team will only receive a Ministry of Education certificate without prize money. The prize money will be passed to the next ranked team, with both teams listed at the same ranking. This rule is not retroactive and award counts start from the 2022 Fall Competition.
- Teams ranking in the top 25% of the Private Leaderboard whose scores exceed the baseline set by the judging committee (not exceeding 30 teams), after review and approval of their reports, will receive either a physical Ministry of Education certificate or an electronic certificate from the Ministry of Education AI Competition Project Office according to competition regulations. Note that advisors cannot register with students but should be listed in the registration system and final report.
- The Private Leaderboard total ranking refers to teams that have submitted answers and completed the competition to obtain a Private Leaderboard score. Teams that fail to submit answers by the deadline or fail to correct submission errors are considered to have withdrawn and will not be included in the total ranking.
- Winning teams of the "Student Group Ranking Award" will receive a Ministry of Education certificate after review by the organizer's judging committee. Team members' personal information used for certificate creation and award distribution will be based on the information provided in the registration system (final modification deadline is the same as the report submission deadline).
- The number of "Student Group Ranking Awards" may be adjusted based on the number of participants and performance. If entries do not meet standards, the organizer's final selection committee may adjust/revoke rankings, declare vacancies, or select fewer winners.
- "Student Group Ranking Award" winning teams must agree to allow the competition supervisory unit and organizing unit to use or share the reports or code submitted by excellent winning teams for non-profit purposes such as teaching, talent cultivation, or academic research.
- Winning teams must delegate at least one representative to attend subsequent award ceremonies and presentation sharing as notified by the organizer. If no teammate is available, a friend or family member may represent the team at the award ceremony and presentation, and agree to allow the competition supervisory unit and organizing unit to use or share the presentations and videos submitted by excellent winning

teams for non-profit purposes such as teaching, talent cultivation, or academic research.

- Due to registration eligibility verification and award data review requirements, please ensure that the name registered in your T-Brain account is your correct Chinese name. If necessary, corrections can be made through the My Profile function in your T-Brain account.

3. Trend Micro AI Talent Cultivation Awards: Winning teams must agree to the following arrangements from the organizer, otherwise they will forfeit their eligibility to receive awards.

    - This award provides additional prize money to the top two teams of the "Student Group Ranking Awards" and aims to encourage winning teams to openly share their reports and source code within the scope of the competition's objectives, talent cultivation, and educational purposes. The top two teams of the "Student Group Ranking Awards" have the right to refuse to publicly share their competition results; however, such refusal will be regarded as forfeiting the additional prize money of the "Trend Micro AI Talent Cultivation Awards." In such cases, the organizer will approach the next eligible teams in ranking order as replacements.
    - There are two "Trend Micro AI Talent Cultivation Awards" in total, with each winning team receiving a prize of NT$20,000. At least one team member must have Republic of China (Taiwan) citizenship or hold a Republic of China work or student visa for the team to be eligible for the award.
    - Winning teams of the "Trend Micro AI Talent Cultivation Awards" agree to grant the Ministry of Education of the Republic of China and its affiliated schools a royalty-free license to use the reports and source code submitted during the competition. Such materials may be publicly used within the scope of the competition's objectives and for purposes of talent cultivation and education (including but not limited to courses under the Ministry of Education's AI Competition and Annotation Data Collection Project), in classrooms, academic research, sharing, or discussions.
    - All members of the winning team must sign an authorization agreement, granting the Ministry of Education of the Republic of China and its affiliated schools a royalty-free license to publicly use the awarded reports and source code within the scope of talent cultivation and educational purposes, including classroom teaching, academic research, sharing, and discussions. If any team member disagrees or fails to sign the authorization agreement within the specified deadline, the entire team will be deemed to have forfeited the additional prize money of the "Trend Micro AI Talent Cultivation Awards." However, this will not affect the team's eligibility for the "Student Group Ranking Awards."

- Prize money will be distributed via New Taiwan Dollar bank transfer. Qualifying winning teams must designate a team member with a local NTD bank account to receive the prize money. This team member will be responsible for income tax reporting to the Republic of China tax authorities and must sign required documents including tax forms and personal information usage agreements.

4. Teams ranking in the top 25% of the Private Leaderboard (not exceeding 30 teams), after submitting reports as required and being approved by the organizer's judging committee, will receive an electronic certificate from the Ministry of Education AI Competition Project Office.

Evaluation Criteria

1. Please submit files in .txt format (containing all answers corresponding to each Patient ID). The content must follow the competition format requirements (for details on the required fields and format of the submission file, please refer to the reference document in the download section). The uploaded file content should use UTF-8 (without BOM) encoding and Unix system line break characters. Please do not use other Non-Printable Characters to avoid potential scoring failures.
2. The Leaderboard system will evaluate the results of each submission, displaying the highest score on the Leaderboard. If multiple participating teams have the same score, ranking order will be determined by submission time.
3. During the competition, participating teams can check the evaluation scores of each upload on the Leaderboard and Submission History for reference. Submission History will provide the score for each evaluation.
4. During the competition period, only Public evaluation scores and rankings will be provided for reference. All Private evaluation scores will not be published. After the competition ends, the Private Leaderboard results will be announced separately, and this Private score along with the required submitted report will be used as the basis for ranking.
5. The Private Leaderboard total ranking refers to teams that have submitted answers and completed the competition to obtain a Private Leaderboard score. Teams that fail to submit answers by the deadline or fail to correct submission errors are considered to have withdrawn and will not be included in the total ranking.
6. The competition Training Dataset will be available for download on Friday, September 19th at 11:00 AM, Testing Dataset will be available for download on Friday, October 3rd at 11:00 AM, at which time answer uploading can begin.
7. Between 11:00 AM on Friday, October 3rd and 11:59:59 PM on Sunday, November 30th, prediction results for the competition Testing Dataset can be uploaded. Submissions after this deadline will not be evaluated. During this period, there is a daily upload limit of 3 times, with each file counting toward the daily upload limit.

Evaluation Method

The model should predict the class, confidence score, and the (x, y) coordinates of the top-left and bottom-right corners of the bounding box. Model performance will be evaluated using the AP@0.5 score (Average Precision at IoU ≥ 0.5) :

$$AP = \sum_{i=1}^{n} (R_i - R_{i-1}) * P_i$$

- R_i : The i − th recall value
- P_i : The smoothed precision value

$$precision = \frac{TP}{TP + FP} \text{ 、 } recall = \frac{TP}{TP + FN}$$

- TP : True Positive、FP : False Positive、FN : False Negative

Scoring Example

If the test data includes four predicted bounding boxes, their class, confidence score, and the (x, y) coordinates of the top-left and bottom-right corners are as follows.

Img_name(excluding .png)－space－class－space－top-left x-coordinate－space－top-left y-coordinate－space－bottom-right x-coordinate－space－bottom-right y-coordinate
1005_image_00078 0 597 607 634 651
1005_image_00079 0 594 606 628 653
1020_image_00195 0 609 449 710 619
1020_image_00215 0 607 491 741 625

If someone uploads a file as follows,

Img_name(excluding .png)－space－class－space－Confidence score－space－top-left x-coordinate－space－top-left y-coordinate－space－bottom-right x-coordinate－space－bottom-right y-coordinate (Note: For this competition, there is only one category for answer submission. Therefore, the input value for the "class" field should always be 0.)

1005_image_00078 0 0.6304 602 611 629 653
1005_image_00079 0 0.7024 601 608 632 657
1020_image_00195 0 0.7142 577 417 701 624
1020_image_00195 0 0.3316 618 447 703 624

1020_image_00215 0 0.5922 636 467 747 581

The score will be calculated according to the following process:

1. Reorder the predicted bounding boxes based on their confidence scores.
   1020_image_00195 0 0.7142 577 417 701 624
   1005_image_00079 0 0.7024 601 608 632 657
   1005_image_00078 0 0.6304 602 611 629 653
   1020_image_00215 0 0.5922 636 467 747 581
   1020_image_00195 0 0.3316 618 447 703 624
2. Match the predicted bounding boxes one by one based on their confidence scores. For the following predictions and ground truths:

   - **Prediction:** 1020_image_00195 0 0.7142 577 417 701 624
   Ground Truth: 1020_image_00195 0 609 449 710 619
   Since **IoU ≥ 0.5**, it is classified as **True Positive** (hereafter referred to as **P1**).

   - **Prediction:** 1005_image_00079 0 0.7024 601 608 632 657
   Ground Truth: 1005_image_00079 0 594 606 628 653
   Since **IoU ≥ 0.5**, it is classified as **True Positive** (hereafter referred to as **P2**).

   - **Prediction:** 1005_image_00078 0 0.6304 602 611 629 653
   Ground Truth: 1005_image_00078 0 597 607 634 651
   Since **IoU ≥ 0.5**, it is classified as **True Positive** (hereafter referred to as **P3**).

   - **Prediction:** 1020_image_00215 0 0.5922 636 467 747 581
   Ground Truth: 1020_image_00215 0 607 491 741 625
   Since **IoU = 0.44659735349716445 < 0.5**, it is classified as **False Positive** (hereafter referred to as **P4**).

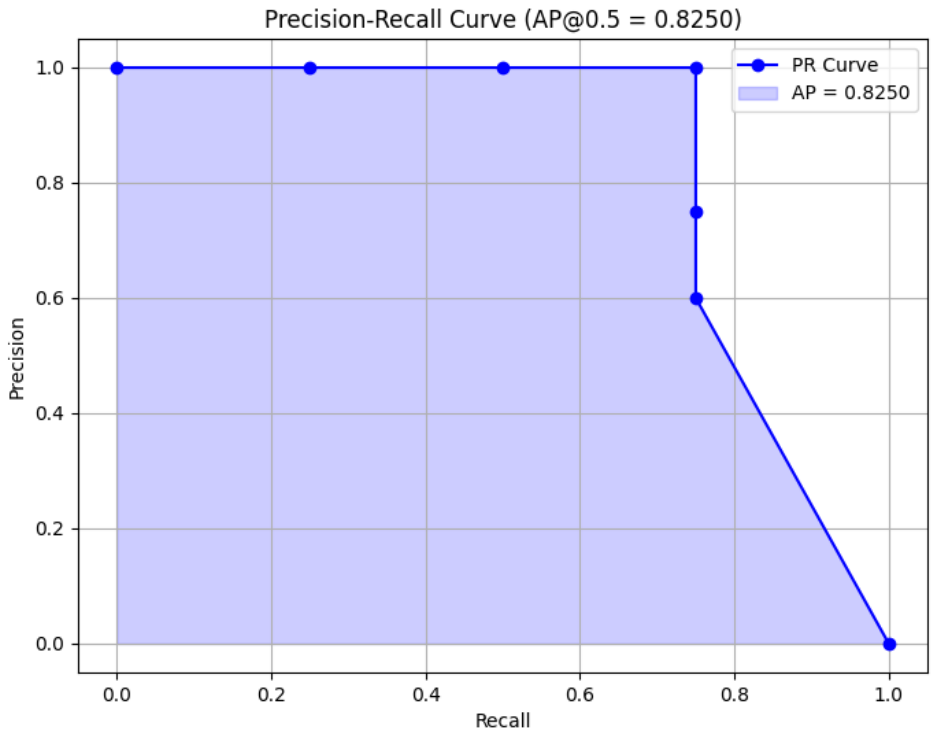
   - **Prediction:** 1020_image_00195 0 0.3316 618 447 703 624
   Ground Truth: 1020_image_00195 0 609 449 710 619
   Although **IoU ≥ 0.5**, this ground truth has already been matched earlier (with P1), so it is classified as **False Positive** (hereafter referred to as **P5**).

3. Calculate Precision and Recall in the order of the predicted bounding boxes.

prediction	Evaluation	Precision	Recall
P1	TP	TP(0+1)/TP(0+1)+FP(0) =1/1=1	TP(0+1)/TP(0+1)+FN(4-1) =1/4=0.25
P2	TP	TP(1+1)/TP(1+1)+FP(0) =2/2=1	TP(1+1)/TP(1+1)+FN(3-1) =2/4=0.5
P3	TP	TP(2+1)/TP(2+1)+FP(0) =3/3=1	TP(2+1)/TP(2+1)+FN(2-1)

			=3/4=0.75
P4	FP	TP(3)/TP(3)+FP(0+1) =3/4=0.75	TP(3)/TP(3)+FN(1) =3/4=0.75
P5	FP	TP(3)/TP(3)+FP(1+1) =3/5=0.6	TP(3)/TP(3)+FN(1) =3/4=0.75

4. Calculate the area under the Precision-Recall curve to obtain the AP score.



Competition Rules

1. Daily submission limit is 3 answers.
2. **Participating teams are not allowed to use self-created data.**
3. Teams may use publicly available open-source resources (e.g., pre-trained models) to improve model training results.
4. Participants must use machine learning/deep learning methods for identification. Manual correction of identification results is prohibited, but the impact and analysis of self-created data or open-source resources on the model can be discussed in the written report submitted at the end of the competition.

5. If using additional external open-source data, or generative AI tools, including but not limited to third-party open-source programs on the internet or reference code provided by instructors in class, teams must comply with the Copyright Law of the Republic of China. Participating teams should provide relevant sources in the written report submitted at the end of the competition and explain the contribution of external data to the competition results. In case of disputes, the organizer reserves the right to make the final decision.
6. To ensure fair competition, teams ranking in the top 25% of the Private Leaderboard and scoring above the baseline set by the review committee (not exceeding 30 teams) must submit a final report after the competition, including (but not limited to): (1) team members, (2) model algorithm description, (3) data preprocessing source code explanation, (4) model training and prediction source code and explanation, (5) parameter settings (including training weights) explanation, (6) program execution environment explanation, (7) whether additional resources were used and their sources. Reports will be reviewed by a panel of experts from the Ministry of Education's AI Competition and Annotation Data Collection Project Office. The completeness and accuracy of the report will affect award qualification and final ranking.
7. Uploaded results must not be manually corrected to avoid affecting competition fairness.
8. Teams may not privately share programs and feature values with each other. Reports should be written independently. However, public discussions in the official discussion forum are allowed, and publicly shared information that is referenced by other teams is exempt from this restriction.
9. Teams should protect their data processing, model programs, and related ideas. Do not privately share or transfer code, draft reports, or other materials to other teams during the competition. If reports and programs from different teams are found to be similar, it will affect the evaluation scores of all involved teams. In serious cases, award qualification may be revoked.
10. If necessary, the organizer has the right to adjust the dataset during the competition.
11. The organizer may disqualify participants or revoke award eligibility without notice if there is concrete evidence of:
    - Plagiarism, cheating, or fraud by the team
    - Infringement of intellectual property right
    - Attacks on the Leaderboard system
    - Actions affecting other participating teams causing unfair situations
    - Violations of the competition rules, "T-Brain AI Platform Service" terms of use, or participant terms of use of this competition

12. The organizer reserves the right to interpret and adjudicate the event and competition rules.

Award Details

Awards for the Computed Tomography Myocardium Image Segmentation II - Aortic Valve Object Detection

Award Name	Number of Recipients	Prize Money
[Student Group Ranking Award] 1st Place	1 team	25,000
[Student Group Ranking Award] 2nd Place	1 team	15,000
[Student Group Ranking Award] 3rd Place	1 team	10,000
[Student Group Ranking Award] Excellence Award	3 teams	3,000
[Student Group Ranking Award] Merit Award	8 teams	2,000
[Trend Micro AI Talent Cultivation Award]	2 teams	20,000

In addition to the prize money, the top 14 teams in the Student Division will receive a "Ministry of Education Certificate." Teams ranking from 15th to 30th place and within the top 25% who submit reports according to regulations and pass the review by the organizing committee's judges will receive a "Project Office Electronic Certificate," regardless of their identity.

Competition Schedule

Item	Timeline	Description
Registration Period	September 16, 2025 – November 25, 2025	Open for registration
Training Dataset Download	September 19, 2025 – November 30, 2025	• From 11:00 AM on September 19, competition teams can download the training dataset.
Testing Dataset Download and Model Prediction	October 3, 2025 – November 30, 2025	• Testing Dataset includes Public Dataset and Private Dataset. Final competition scores will be calculated based on Private Dataset results. • From 11:00 AM on October 3, competition teams can download the competition Testing Dataset, and begin uploading predictions for scoring. The Leaderboard will use the highest-scoring submission. During this period, participants can view Public Score results for reference. In case of ties, ranking will be determined by submission time, with earlier uploads ranked higher. • During this period, there is a limit of 3 prediction submissions per day, counted by file. • The deadline for answer uploads is 11:59:59 PM on November 30, 2025. Late submissions will not be accepted. Competitors must upload files within the specified time. Answer files must follow the required format to avoid upload failures.
Results Announcement	December 2, 2025 4:00 PM	Private Leaderboard scores announced

Report Submission	December 2, 2025 – December 9, 2025	Submit documentation explaining their training and prediction models and code
Final Ranking Announcement	January 30, 2026 4:00 PM	Final rankings of the competition announced
Award Ceremony	Early 2026 (tentatively scheduled for Q1)	The award ceremony details will be announced separately

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Competition Guidance Unit: Information and Technology Education Department of the Ministry of Education

Competition Planning Unit: Artificial Intelligence Competition and Annotation Data Collection Project Office of the Ministry of Education

Topic Provider: Department of Computer Science and Information Engineering, National Taipei University of Technology

Co-Organizers: Heart Center, Cheng Hsin General Hospital

Platform Sponsor: Trend Micro

Q&A

If you have any questions about the competition, you are welcome to raise them in the Discussion Area. If you prefer not to ask in the public discussion forum, please submit your questions through the AI CUP 2025 Fall Competition - Computed Tomography Myocardium Image Segmentation II - Aortic Valve Object Detection inquiry form (https://forms.gle/fw3Kcc3W3Ct7WJWM6), or email them to t_brain@trendmicro.com.

Courses

The organizers will be offering free AI CUP roadshow courses throughout the country. Interested participants are welcome to visit the AI CUP website (https://moeaincu.wixsite.com/aicup) for the latest news, or follow the Facebook fan page (https://www.facebook.com/AICUPrealtask).