2025

BRICS SKILLS COMPETITION

(BRICS+ FUTURE SKILLS & TECH CHALLENGE)

Artificial Intelligence and Computer Vision Application

BRICS-FS-26

Technical Description

(International Final-Online)

August, 2025

Contents

1. Introduction

1.1 Skill Competition Name and Description

1.1.1 Name of the Skill Competition

2025 BRICS Skills Competition (BRICS Future Skills and Technology Challenge) – Artificial Intelligence and Computer Vision Application. Competition Code: BRICS-FS-26.

1.1.2 Description of the Skill Competition

The 2025 BRICS Skills Competition (BRICS Future Skills Challenge) Artificial Intelligence and Computer Vision Application event is based on a competition platform and consists of three parts: AI model training environment setup, data processing and analysis, and computer vision (robot) application. Competitors need to build an AI-related environment, perform operations such as data cleaning, data processing, data visualization, dataset splitting, model construction, model training, model tuning, model prediction, and model saving, and finally be assessed by completing specific tasks with a robot. The Artificial Intelligence and Computer Vision Application competition is a two-person team event.

1.1.3 Technical Specifications

1.1.3.1 Data Collection and Processing

Ability to develop detailed data collection plans and processing specifications based on business requirements and AI model technical demands. This includes conducting strict quality audits on pre-processed business data, checking for consistency, accuracy, completeness, and timeliness. Ability to define data collection specifications, clarifying data sources, collection frequency, data formats, and interface protocols. Simultaneously, formulate data processing specifications covering key steps like data cleaning, transformation, normalization/standardization, and feature engineering to ensure a stable and efficient data flow.

1.1.3.2 Data Annotation

Proficient in using professional data annotation tools (e.g., LabelImg, Labelme, VOTT) to analyze diverse and complex raw data (images, videos, etc.) to identify internal correlations and core features. Ability to define clear annotation rules and label systems based on analysis results and model training objectives. During annotation, effectively classify data and accurately correct annotation errors (e.g., missed labels, incorrect labels, inaccurate boundaries) found during review. Finally, complete the

selection and construction of high-quality datasets based on the results of the annotation quality audit and manage their versions.

1.1.3.3 Intelligent System Operation and Maintenance

Possess the ability to maintain and manage the data required for intelligent systems, including data storage, backup, updates, and version control. Ability to find and evaluate the most suitable application scenarios for specific intelligent products or algorithm modules and conduct feasibility analysis. Proficient in using data analysis tools (e.g., Python's Pandas, Matplotlib, Seaborn libraries) to conduct in-depth analysis of system operation data and model performance data, and write analysis reports containing problem diagnosis, performance trends, and optimization suggestions. Based on the conclusions of data analysis, propose specific and feasible optimization requirements for single or multiple functions of intelligent products.

1.1.3.4 Business Analysis

Ability to deeply integrate AI technology requirements with specific business scenario characteristics to design a complete business process from data collection, processing, and auditing to model application. Possess keen business insight, able to combine business knowledge to accurately identify single or multiple modules in existing business processes that can be optimized by AI, and design innovative and feasible optimization plans to promote their implementation. Ability to comprehensively evaluate the key and difficult points of the business process, and combine cutting-edge AI technology to build a business framework that is structurally reasonable, logically clear, and scalable.

1.1.3.5 Intelligent Training

Responsible for the daily maintenance and iteration of high-quality training, validation, and test sets, including data augmentation, sample balancing, and data expansion. Ability to use automated testing tools or write scripts to comprehensively test the functionality, performance, and robustness of AI products. Ability to conduct in-depth analysis of test results, locate the causes of false positives/negatives, and propose corrective measures at the algorithm or data level. Ability to lead the construction of a "Golden Test Set" to measure the upper limit of the algorithm model based on business characteristics, and use it as the final quality assurance standard before the model goes live.

1.1.3.6 Intelligent System Design

Design and optimize human-computer interaction methods and processes for specific

application scenarios by analyzing user behavior and system performance data to achieve the optimal balance of efficiency and user experience. Ability to design comprehensive solutions involving multiple intelligent products (e.g., image recognition, object tracking, behavior analysis) in complex business domains and promote their cross-team implementation. Ability to translate abstract solutions into specific and detailed Product Requirement Documents (PRDs), collaborate with engineers, designers, and other roles to promote the iterative development of product functions, and be responsible for achieving the final project goals.

1.2 Relevance and Importance of This Document

This document contains the standards required for this skill competition and information on the assessment principles, methods, and procedures for managing the competition.
Every Expert and Competitor must know and understand this Technical Description.
In the event of any conflict between the different language versions of the Technical Description, the English version shall take precedence.

2. Skill Standard

2.1 General Description of the Skill Standard

The Skill Standard specifies the knowledge, understanding, and specific skills that underpin international best practices in technical and vocational performance. It should reflect a shared global understanding of what the associated work role or occupation represents for industry and business.
The skill competition is intended to reflect international best practices as described in this Skill Standard, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.
The Standard is divided into distinct sections with headings and reference numbers.
Each section is assigned a percentage of the total marks to indicate its relative importance within the Standard. This is often referred to as the "weighting." The sum of all percentages is 100. The weightings determine the allocation of marks in the Marking Scheme.
Through the Competition Project, the Marking Scheme will assess only those skills that are set out in the Standard. They will reflect the Standard as comprehensively as possible within the constraints of the skill competition.
The Marking Scheme will follow the allocation of marks within the Standard to the extent practically possible. A variation of 5% is allowed, but this must not distort the weightings assigned by the Standard.

2.2 The Skill Standard

Section	Relative Importance (%)
1. Work Organization and Management	**5%**
The competitor needs to know and understand:	
- The purpose and use of all equipment and materials	
- Principles and methods of work organization, control, and management	
- Principles of communication and cooperation	
- Principles and techniques of time management	
The competitor shall be able to:	
- Prepare and maintain a safe, clean, and efficient work area	
- Maximize efficiency and minimize schedule interruptions	
- Restore the workstation area to an appropriate state	
2. Communication Skills	**5%**
The competitor needs to know and understand:	
- Time requirements for each competition task	
- The structure and content of competition documents	
- The competition schedule and marking rules	
The competitor shall be able to:	
- Understand tasks	

- Clearly express ideas	
- Adhere to timelines	
- Comply with competition rules	
3. Artificial Intelligence Environment Setup	**20%**
The competitor needs to know and understand:	
- Basic Linux commands	
- Basic Python environment requirements	
- Basic AI environment requirements	
- Installation methods for common software packages in Ubuntu	
- Installation knowledge in an offline environment	
The competitor shall be able to:	
- Install software via the command line in an Ubuntu system	
- Master basic operations using Linux commands	
- Correctly understand the requirements for setting up the AI environment	
- Submit the completed task results	
4. Data Processing and Analysis	**35%**
The competitor needs to know and understand:	
- Familiarity with common image processing libraries	
- Mastery of basic knowledge of image data	

- Clear understanding of image data processing methods	
- Knowledge of the meaning of various data processing method parameters	
- Clear understanding of image data cleaning methods	
- Clear understanding of data storage methods	
- Mastery of the basic use of data visualization libraries	
- Familiarity with the drawing methods and parameter settings of common visualization charts	
The competitor shall be able to:	
- Understand task requirements	
- Use common image processing libraries for data cleaning operations	
- Use common image processing libraries for data preprocessing operations	
- Use deep learning for image preprocessing operations	
- Use common visualization libraries to display processed data	
- Set chart display parameters according to requirements	
5. Computer Vision Application	**35%**
The competitor needs to know and understand:	

- The structure and parameter meanings of common neural network models for computer vision	
- Knowledge of common deep learning frameworks	
- The process of building a deep learning model	
- The meanings and pros and cons of common loss functions	
- The meanings and characteristics of common activation functions	
- The meanings and characteristics of common optimizers	
- The meanings and selection of common model evaluation metrics	
- Learning rate adjustment strategies	
- Application scenarios and main tasks in the field of computer vision	
The competitor shall be able to:	
- Understand the requirements of real-world tasks	
- Load and preprocess datasets according to requirements	
- Reasonably partition datasets	
- Build a deep learning model architecture	
- Call provided pre-trained models	
- Debug model parameters based on training	

results	
- Save and debug the model with the best performance for prediction	
- Provide visual representation of the training process	
- Call the model to verify the target	
Total	**100%**

3. Registration and Team Organization

3.1 Competitor Eligibility Criteria

There are no separate competition groups for the 2025 BRICS Skills Competition. Students and teachers from vocational colleges (including higher vocational undergraduate and technical colleges) and undergraduate institutions, as well as employees of enterprises and public institutions, who are between 16 years old (born before January 1, 2009) and 35 years old (born after January 1, 1990), are eligible to register as competitors.

3.2 Team Composition

Each team consists of competitors, experts (coaches), and support staff (team leader). Competitors and experts are mandatory for registration.
For individual competitions, each team is limited to one expert. For team competitions, each team is limited to two experts. Within the same team, the expert and competitor cannot be the same person.

3.3 Advancement Rules

- If the number of valid registered units is less than or equal to 10, two teams from each project will advance.
- If the number of valid registered units is greater than 10, 20% of the teams will advance.
- Only one team from the same unit can advance in the same competition event.

4. Marking Scheme

4.1 Marking Method

4.1.1 Result Scoring

The competition results submitted by the competitors will be evaluated and scored according to the event's evaluation criteria.

4.1.2 Decryption

After the Chief Expert formally submits the workstation number scoring results and they are confirmed to be correct, the encryption judge will decrypt the encrypted results layer by layer under the supervision of supervisors. This competition uses reverse decryption.

4.1.3 Random Inspection and Review

To ensure the accuracy of the scoring, the arbitration group will review the scores of all teams (competitors) ranking in the top 30% of the total score. For the remaining scores, a random inspection review will be conducted, with a coverage rate of no less than 15%.
The arbitration group must promptly inform the Chief Expert in writing of any errors found during the review. The Chief Expert will then correct the scores and sign to confirm.
If the error rate of the review and random inspection exceeds 5%, it will be considered a non-small probability event, and the judging panel must review all scores.

4.1.4 Announcement

The competition results will be announced at the closing ceremony. The scoring for this competition will be completed on-site by the judging panel. If a competitor is found to have cheated or engaged in other violations during the competition, the judges will handle the situation according to the severity of the violation, with serious cases resulting in disqualification.

4.2 Marking Rules

4.2.1 The competitor with the higher total score ranks higher.
4.2.2 If total scores are tied, the competitor with the higher score in Module C, then Module B, then Module A will rank higher.
4.2.3 If the ranking cannot be determined by the above two rules, the competitor with the shorter cumulative competition time will rank higher.

4.3 Assessment Criteria

During the competition design process, the choice of standards and assessment methods will

be determined by the marking scheme and the competition project.
The assessment criteria include, but are not limited to:

Module	Competition Task	Scoring Point	Scoring Standard	Marks
A	**Comprehensive Application in Industrial AI Scenarios**	**Scenario Analysis**	The report is logically clear, complete, includes an analysis of pain points in the existing process, an assessment of data availability, definition of Key Performance Indicators (KPIs), and clearly quantifies the expected business value of the AI application.	**15**
		Solution Design	The plan should detail the rationale for technology selection (e.g., model, framework), system architecture diagram, data	

			processing flow, model training and deployment strategy, and assess potential technical risks and countermeasures. The innovation, feasibility, and completeness of the plan will be the main scoring criteria.	
B	**AI Machine Vision Dataset Creation**	**Dataset Scale and Diversity**	The dataset size meets basic requirements, and samples show good diversity in lighting, angles, backgrounds, occlusions, etc., effectively covering various changes in real application scenarios.	**35**
		Data Quality	Effectively handles noise (e.g., blur, occlusion), duplicate data, and inconsistent formats through	

			data cleaning scripts or tools. Data quality will be assessed based on the accuracy, consistency, and completeness of the cleaned data.	
		Annotation Accuracy	Bounding boxes/regions should tightly fit the target boundaries, and class labels must be correct. Assessment will be done through random sampling or comparison with ground truth (e.g., calculating IoU), with an error rate below a preset threshold.	
		Annotation Consistency	A clear annotation specification document is provided. High consistency is demonstrated by ensuring that	

			annotations of different samples follow a unified standard, verified through methods like cross-validation or calculating inter-annotator agreement (e.g., Kappa coefficient).	
		Dataset Balance	The distribution of samples for each class in the dataset is analyzed, and effective measures (e.g., oversampling, undersampling, data augmentation) are taken to mitigate class imbalance issues, preventing the model from being biased towards majority classes.	
		Dataset Accessibility	The dataset is organized in a standard format (e.g., COCO,	

			VOC) with a clear directory structure, and a clear README file or user guide is provided for others to quickly understand and use.	
		Dataset Scalability	The design and organization of the dataset have good scalability, facilitating the incremental addition of new data, classes, or annotation information in the future, and supporting dataset version control.	
		Dataset Security and Privacy Protection	When handling data involving sensitive information, effective anonymization measures (e.g., face blurring) are taken to ensure that the use of the dataset complies with relevant data	

			security and privacy protection regulations.	
		Dataset Documentation and Description	Detailed dataset documentation is provided, including but not limited to: data source, collection method, scenario description, annotation rules, statistics of sample counts for each class, and visual analysis.	
		Technical Innovation and Methodology	Innovative data augmentation techniques, semi-automated/ active learning annotation methods, or efficient quality control processes are used in the dataset creation process, significantly improving the efficiency or	

			quality of dataset production.	
		Practical Application Potential of the Dataset	The dataset is built around a valuable practical application problem, is of high quality, has comprehensive scenario coverage, and has the potential to be directly used for developing real-world AI projects.	
C	**AI Machine Vision Model Training**	**Model Selection and Design**	Reasonably selects or designs a model (e.g., YOLOv5/v8, ResNet) based on task requirements (e.g., real-time performance, accuracy) and data characteristics. The rationale for selecting the model must be explained. The model structure	**40**

			design should balance performance and efficiency, and effective strategies (e.g., regularization, Dropout) should be used to prevent overfitting.	
		Data Preprocessing	The data loading and preprocessing flow is efficient and correct, including but not limited to image size normalization, application of data augmentation strategies (e.g., random flipping, cropping, color jittering), and the augmentation strategies match the task requirements.	
		Model Training Process	The training process is stable, and the loss function converges	

			properly. The optimizer and learning rate scheduling strategy are well-chosen. The training process can be effectively monitored, and checkpoints are saved.	
		Model Performance Evaluation	Appropriate evaluation metrics are chosen (e.g., mAP for object detection, Accuracy/Precision/Recall/F1 for classification), and the evaluation process is rigorous. Can generate and interpret confusion matrices, P-R curves, and other visual results to comprehensively analyze the model's performance on	

			different classes.	
		Model Generalization Ability	The model performs well on an independent validation or test set, with little performance gap compared to the training set, demonstrating that the model is not severely overfitted and has excellent generalization ability.	
		Hyperparamete r Tuning	Systematic tuning experiments are conducted on key hyperparameters (e.g., learning rate, batch size, optimizer parameters), and the tuning process and results can be presented, proving that the final model performance benefits from scientific tuning methods.	

		Model Interpretability	Can use tools or methods (e.g., Grad-CAM, SHAP) to visually explain the model's decisions, analyzing whether the feature regions the model focuses on are as expected, enhancing the model's credibility.	
		Model Robustness	The model's stability is evaluated by testing on perturbed data (e.g., noise, adversarial samples). The model's prediction results should remain relatively stable in the face of minor disturbances.	
		Code Quality and Documentation	The code structure is clear, highly modular, follows coding standards like	

			PEP8, and key parts have detailed comments. Complete code execution instructions and dependency environment configuration documents are provided.	
D	**Safety Awareness and Professionalism**	**Equipment Check**	Before starting operations, systematically checks the connection and status of all hardware (e.g., robot, PC), confirms that safety devices like emergency stop switches are effective, and records the check results.	**10**
		Equipment Preparation	Proactively monitors equipment battery levels and charges them in a timely manner when low, effectively preventing task	

			interruption or data loss due to power failure during the competition.	
		Data Archiving	During and after the competition, systematically organizes, names, and archives all digital assets (code, models, reports, datasets) according to professional standards and requirements, with a clear directory structure for easy reference.	
		Equipment Operation	Strictly follows operating procedures when using equipment, with no rough handling. No equipment damage or failure due to improper operation throughout the	

			competition. After the competition, all equipment, tools, and instruments are returned to their proper places, and the work area is cleaned.	
		Professionalism	Strictly abides by competition discipline and safety regulations throughout the event, demonstrating good teamwork and communication skills, competing in a civilized manner, calmly handling unexpected situations, and maintaining a high level of safety awareness.	
Total				**100**

5. Competition Project

5.1 General Notes

Whether as a single module or a series of independent or related modules, the Competition Project can assess the application of knowledge, skills, and behaviors defined in the Skill Specification.

In conjunction with the Marking Scheme, the purpose of the Competition Project is to provide a comprehensive, balanced, and authentic opportunity for assessment and scoring against the Standard. The relationship between the Competition Project, the Marking Scheme, and the Standard will be a key indicator of quality, just as the relationship between the Standard and actual work performance is.

The Competition Project will not include aspects outside the Standard, nor will it affect the balance of scoring within the Standard.

The assessment of knowledge and understanding in the Competition Project is conducted solely through its application in practical work.

5.2 Competition Project Format/Framework

The Competition Project consists of four relatively independent and interconnected modules:

- **Module A:** Analysis of Industrial AI Scenarios and Solution Design
- **Module B:** Creation of AI Machine Vision Datasets
- **Module C:** Training of AI Machine Vision Models
- **Module D:** Safety Awareness and Professionalism

5.3 Competition Project Time Allocation and Weighting

Module	Duration (min)	Weighting (%)
Module A: Analysis of Industrial AI Scenarios and Solution Design	60min	15%
Module B: Creation of AI Machine Vision Datasets	120min	35%
Module C: Training of AI Machine Vision Models	120min	40%
Module D: Safety Awareness	-	10%

and Professionalism		
Total	**300 min**	**100%**

5.4 Content and Requirements for Each Module

This competition comprehensively assesses the competitors' integrated application capabilities in the field of AI computer vision, covering the entire process from business understanding, solution design, data processing, and model training to final deployment and application, with an ongoing assessment of safety standards and professional ethics.

Module A: Analysis of Industrial AI Scenarios and Solution Design
This module focuses on assessing the competitors' ability to understand and analyze actual industrial scenarios and translate business problems into AI technical solutions.

- **Task 1: Industrial Scenario Analysis and Solution Design**
  - **Description:** For a given industrial application scenario (e.g., parts defect detection, production line material tracking), competitors need to deeply analyze its business processes, pain points, and requirements. Based on the analysis, write a detailed requirements analysis report and design a complete AI solution.
  - **Deliverables:**
    - **Requirements Analysis Report:** Clearly define the AI application objectives, assess data feasibility, and set quantifiable Key Performance Indicators (KPIs).
    - **Solution Design Document:** Include a system architecture diagram, technology selection (model, algorithm, framework) and its justification, a complete data processing and model iteration process, deployment strategy, and an assessment of potential technical risks with proposed countermeasures.

Module B: Creation of AI Machine Vision Datasets
This module focuses on assessing the competitors' practical ability to process and construct high-quality computer vision datasets, which is a key factor determining the upper limit of model performance.

- **Task 2: Data Collection and Processing**
  - **Description:** Competitors need to systematically clean and preprocess the raw dataset using specified tools or by writing scripts according to the task requirements.

    - **Deliverables:** The cleaned dataset must effectively handle noise (e.g., image blur, uneven lighting), remove duplicate data, fill or delete missing values, and unify data formats to ensure high quality and consistency. Submit the processing script and a description of the process.
- **Task 3: Data Annotation**
    - **Description:** Competitors need to use professional annotation tools to accurately annotate the cleaned data (e.g., bounding boxes for object detection, polygons for instance segmentation).
    - **Deliverables:** Submit a clear annotation specification document. The annotation results must ensure high accuracy (tight boundaries, correct classes) and high consistency. The final output should be annotation files in a standard format (e.g., COCO, VOC), with an analysis and handling of the dataset's class balance.

Module C: Training of AI Machine Vision Models

This module focuses on assessing the competitors' core technical capabilities in model construction, training, evaluation, and optimization.

- **Task 4: Model Construction and Training**
    - **Description:** Competitors need to select and build an appropriate deep learning model network based on the task objectives and data characteristics. Configure the training environment, load the preprocessed dataset, and conduct model training.
    - **Deliverables:** Submit complete training code including the model structure, loss function, optimizer, and other key information. The training process should be stable, able to monitor and visualize changes in metrics like loss function and accuracy, and effectively use strategies like regularization and learning rate decay to prevent overfitting.
- **Task 5: Performance Evaluation and Tuning**
    - **Description:** Competitors need to use appropriate evaluation metrics to comprehensively assess the performance of the trained model and perform targeted hyperparameter tuning or model structure adjustments based on the evaluation results.
    - **Deliverables:** Submit a model evaluation report including visual analyses like P-R curves and confusion matrices, with a detailed explanation of the tuning process and rationale. The final submission must include the best-performing model weight file and corresponding inference code.

Module D: Safety Awareness and Professionalism

This module is a continuous assessment of the competitors' overall professional qualities

throughout the competition, with scores recorded in real-time by the judges based on the competitors' on-site performance.

- **Assessment Points:**
  - **Safety Standards:** Strictly adhere to on-site safety operating procedures, carefully check equipment before the competition (especially safety devices like emergency stop switches), and organize and restore the workstation after the competition.
  - **Professional Standards:** Compete in a civilized manner, demonstrating good teamwork. Operate equipment according to standards to prevent damage. Organize and archive all competition materials (code, data, documents) clearly and professionally.
  - **Emergency Response:** Calmly handle unexpected situations (e.g., power outages, software crashes) and take reasonable measures.

5.5 Publication of Sample Competition Project

A sample competition project will be published on the official competition website (http://www.brskills.com/jzzy/index.html) one month before the competition.

5.6 Changes to the Competition Project

The official competition project will have changes of up to 30% from the sample project.

6. Skill Management and Communication

6.1 Expert Group

The Skill Expert Group, consisting of the Chief Expert, Deputy Chief Expert, and Expert members, is responsible for jointly further revising the technical documents related to this competition event.

6.2 Communication and Discussion

Before the competition, participating parties can join the relevant communication group for the drone operation event to discuss questions regarding registration, hardware and software preparation, and exam environment deployment. Communication for training, during, and after the competition for this event can also be conducted through the official communication group.
Online communication will primarily use instant messaging tools (e.g., QQ/WeChat/Telegram).

7. Appeals and Arbitration

If there are instances of unfairness or violations by relevant personnel during the competition, the team may submit a written report, signed by the team leader, to the competition's arbitration working group within 2 hours after the competition ends. The written report should provide a full and factual account of the appeal incident, including the phenomenon, time of occurrence, personnel involved, and basis for the appeal. Non-written appeals will not be accepted. The arbitration working group will organize a review within 2 hours of receiving the appeal and provide feedback on the review results in a timely manner.

8. Safety Requirements

8.1 Organization

8.1.1 A competition safety assurance group will be established, led by the director of the competition's working group. Members will include the safety officers from each competition site. A safety officer will be designated for each site, bearing full responsibility for the safety of that site, and responsible for mobilizing rescue teams and professional rescue personnel and arranging for the evacuation of personnel in case of an accident.
8.1.2 Establish coordination mechanisms with relevant departments such as public security, fire protection, judicial administration, transportation, health, and quality inspection to ensure competition safety, formulate emergency plans, and promptly handle emergencies. Set up dedicated contact lines for medical personnel, firefighters, and security personnel, with designated contacts from their side, to be liaised with by the site safety officer. The layout of the competition venue and the use of equipment will strictly follow safety construction regulations. The venue will be divided into zones, with evacuation routes set up according to safety requirements, and diagrams of safety evacuation routes will be posted in prominent locations on the walls.

8.2 Competition Safety Management

8.2.1 The installation of competition equipment and facilities will strictly follow safety construction standards, with power wiring and electrical installations carried out according to regulations.
8.2.2 Fire extinguishers will be placed according to fire safety requirements, and responsible persons will be designated to use them in emergencies.
8.2.3 The competition's technical regulations will specify the norms, regulations, and qualification certificate requirements for relevant national (or industry) occupational safety.
8.2.4 The competition working group will conduct safety training for all judges and staff before

the competition. According to relevant regulations, a comprehensive safety accident prevention system will be established, and competitors will be trained before the competition to avoid personal injury accidents.

8.2.5 The competition expert group will establish a special plan to ensure the security of the competition's question setting, test paper storage, distribution, collection, and evaluation process.

8.3 Competition Environment Safety Management

8.3.1 Before the competition, the working group will organize personnel to inspect the competition site, accommodation, and transportation arrangements, and set clear safety requirements. The layout of the venue and the equipment within it will comply with national safety regulations. A simulation test of the venue will be conducted to identify potential problems. The host organization will eliminate safety hazards before the competition as required by the working group.

8.3.2 A cordon will be set up around the competition area to prevent unauthorized personnel from entering and to prevent accidents. Within the competition site, necessary labor protection will be provided to competitors in accordance with the requirements of relevant occupations. In hazardous operation links, judges must check and confirm that the equipment is normal before the competition and strictly prevent competitors from making operational errors during the competition.

8.3.3 To ensure the smooth running of the competition, the host college will establish a corresponding safety assurance system for the duration of the event, which will be implemented by the security, campus environment, and medical support groups.

8.3.3.1 During the competition, all vehicles and personnel entering the competition area must present credentials and show them to staff upon request.

8.3.3.2 Before the competition starts, competitors must carefully read the relevant notes and emergency evacuation diagrams.

8.3.3.3 The entire process of checking the electrical control system before power-on will be supervised by the judges, who will promptly remind and stop any operational hazards.

8.3.3.4 Each competition station will use an independent power supply to ensure safety. Competitors should save their work frequently when programming to avoid data loss due to sudden power outages.

8.3.3.5 During the competition, competitors must strictly abide by safety operating procedures. In case of an emergency, they should immediately cut off the power and exit in an orderly manner as directed by the staff.

8.3.3.6 All personnel must strictly abide by the rules of the competition venue and are prohibited from bringing in prohibited items.

8.3.3.7 Security personnel who discover safety hazards should report them to the person in charge of the venue immediately.

8.3.3.8 Smoking is strictly prohibited in the competition venue. Security personnel are not allowed to lend their credentials to others.
8.3.3.9 In the event of a safety issue, evacuate the scene quickly following the emergency evacuation route under the direction of security personnel.
8.3.4 In areas with high-density crowds and intersecting traffic, the working group, together with the host organization, will not only set up complete directional signs and add guidance personnel but also open up backup passages.
8.3.5 During the competition, the host organization will increase manpower at key management posts in the competition venue and maintain a safety management log.
8.3.6 When competitors enter their workstations and judges and staff enter their workplaces, the host organization must remind and supervise them to prohibit carrying communication, photo, and video recording devices, and any unauthorized recording tools. Security checks will be conducted on personnel entering important areas of the competition venue.

8.4 Living Conditions Guarantee

8.4.1 During the competition, the host organization will arrange accommodation and meals for competitors and instructors. The host organization must respect the religious beliefs and cultural customs of ethnic minority participants and arrange for their food and lodging according to national ethnic and religious policies.
8.4.2 The accommodation arranged during the competition must have a hotel or lodging business license.
8.4.3 The competition working group is responsible for the transportation safety of organized tours and observations during the event. The working group and the host organization must ensure the transportation safety of competitors, instructors, judges, and staff during the competition.
8.4.4 In addition to necessary safety isolation measures, personal privacy and freedom will be protected in strict compliance with relevant national laws and regulations.

8.5 Team Responsibilities

8.5.1 When organizing teams, each participating unit must purchase personal accident insurance for the competitors for the duration of the competition.
8.5.2 After forming a team, each unit must establish relevant management systems and conduct safety education for all competitors and instructors.
8.5.3 Each team must strengthen the safety management of its participants and coordinate with the on-site safety management.
8.5.4 Any vehicles belonging to the teams must enter and exit the competition venue with credentials issued by the competition working group, travel on designated routes, and park in designated locations.

8.6 Emergency Response

In the event of an accident during the competition, the discoverer should report it to the competition working group immediately and take measures to prevent the situation from escalating. The working group should immediately activate the emergency plan to resolve the issue. For major safety incidents, the competition working group will decide whether to suspend the competition. Afterward, the working group should issue a detailed report on the situation.

8.7 Penalties

8.7.1 If a major safety accident occurs in a competition event, the host organization's qualification to host the event will be suspended.
8.7.2 If a major safety accident is caused by a participating team, its eligibility for awards will be canceled.
8.7.3 If a participating team has a major safety hazard and fails to comply after being reminded and warned by the on-site staff, its qualification to continue the competition will be canceled.
8.7.4 If event staff violate regulations, they will be held accountable according to the corresponding system. In cases of egregious conduct causing a major safety accident, the judicial authorities will pursue corresponding legal responsibilities.

9. Materials and Equipment

9.1 Infrastructure List

The infrastructure list details all equipment and facilities that the participating parties need to prepare. See the "2025 BRICS Skills Competition Offline Competition - Artificial Intelligence and Computer Vision Application Infrastructure List".

9.2 Competition Equipment List

9.2.1 Hardware Equipment

Equipment	Name	Quantity	Remarks
Competitor Client	PC	50	General Desktop (Minimum Requirements)
			Processor: i7/4C
			Memory: 16G or

			above
			SSD: 256G or above
			Graphics Card: RTX4060 or above
			USB: 3.0
			Network Card: Gigabit or above

9.2.2 Competitor PC Software Installation

No.	Software	Description
1	Operating System	Windows 10 Pro or above
2	Remote Software	SSH (SSH1 and SSH2) terminal emulator and file transfer tool Putty-64bit-0.71-installer
3	AI Data Annotation Platform	- Platform must support configuration through a simple visual interface for fast and flexible annotation task setup. - Must support on-premises deployment and provide detailed deployment documentation and technical support. - Must support modular design, allowing different annotation tools to be combined to meet diverse needs. - Must have a built-in SQLite database and support migration to MySQL for

		higher data storage and concurrency needs. - Must provide clear API interfaces for secondary development and system integration. - Must support multiple data import methods, including local file upload and server path import. - Must support exporting to multiple mainstream data formats, including at least JSON, COCO, and MASK, to be compatible with different model training frameworks. - Must support version management for annotated data for easy tracking and rollback. - Must support multiple image annotation tools, including 2D bounding boxes, polygon segmentation, polylines, keypoints, etc., to adapt to different computer vision tasks like object detection and scene segmentation. - Must support attribute editing for annotation results, such as labels, colors, IDs, etc. - Must support layer management for easy annotation of multiple objects in complex scenes. - Must support frame-by-frame and keyframe annotation for videos to improve video annotation

		efficiency. - Must support video segmentation, classification, and information extraction for applications like action recognition and video content retrieval. - Must support continuous tracking and annotation of objects in videos. - Must support audio segmentation, classification, and information extraction annotation functions. - Must support visual display of audio waveforms and annotation on the waveform. - Must support loading pre-annotation models for automatic pre-annotation of data, followed by manual correction and fine-tuning to improve efficiency and accuracy. - Must support "learn-while-annotating" online learning capability, where the model learns from new annotations in real-time to provide more accurate pre-annotations for subsequent data. - Must support multi-user collaborative online annotation and manage permissions for different users. - Must support task assignment and progress tracking for annotation tasks. - Must support quality inspection and review of

		annotations to ensure data quality.
4	AI Model Training Platform	- Must support mainstream deep learning frameworks like PyTorch and provide end-to-end model training and management capabilities. - Must have built-in support for multiple mainstream YOLO series object detection model architectures, including at least YOLOv5 and YOLOv8, and be easily extensible to support new models in the future. - Must support loading pre-trained weights for transfer learning to accelerate model convergence and improve performance on specific tasks. - Must support multiple computer vision tasks, including but not limited to object detection, instance segmentation, image classification, and keypoint detection (pose estimation). - Must support users uploading custom datasets and be compatible with automatic parsing of standard dataset formats like COCO and VOC. - Must have powerful built-in data augmentation functions, supporting online image transformations with various strategies like random

		scaling, color space adjustments, Mosaic data augmentation, etc., and allow users to disable some augmentation strategies before training (e.g., in the last few epochs). - Must support dataset version management, allowing users to trace the data used in different experiments. - Must provide a dataset caching mechanism, automatically downloading and storing standard datasets after the first use to improve subsequent call efficiency. - Must support flexible configuration of training hyperparameters via a web interface or configuration file (e.g., YAML format), including learning rate, batch size, epochs, optimizer, weight decay, etc. - Must provide a visual training monitoring interface, displaying real-time change curves of key performance indicators (Metrics) such as Loss, mean Average Precision (mAP), etc., and support exporting monitoring results. - Must support resume-from-checkpoint functionality, allowing users to continue training from the last interrupted state to save time

		and computing resources. - Must support multi-GPU parallel training and automatically optimize GPU resource allocation, seamlessly scaling training capabilities to accelerate large-scale training tasks. - Must have a built-in model evaluation module that automatically calculates key evaluation metrics like mAP, Precision, and Recall on the validation set and generates visual reports. - Must support side-by-side comparison and analysis of training results from different versions, helping users select the optimal model. - Must support one-click export of trained models to various inference formats like ONNX, TensorRT, etc., to adapt to different CPU, GPU, and edge device deployment environments. - Must provide a model inference testing interface, allowing users to upload images or videos to quickly verify the performance of the trained model. - Must provide easy-to-use command-line tools (CLI) and Python interfaces for developers' secondary development and

		automated task orchestration. - Must adopt advanced technologies such as Anchor-Free detection heads to improve model detection efficiency and accuracy. - Must have a complete user permission management and resource isolation mechanism to ensure data and model security in a multi-user environment. - Must provide detailed technical documentation, API references, and operating tutorials to lower the barrier to entry and use for users.
5	Other Software	Common tools including document processing, browser, input method, compression software, image viewer, etc.: W.P.S. 11294.12012.2019, ChromeSetup_64, KanKan, npp.7.6.6, setup-lightshot, sogou_pinyin_93f, sogou_wubi_31a, winrar-x64-570, VirtualBox

9.3 Materials and Equipment Prohibited in the Skill Area

Any materials and equipment brought by the competitors should be declared (presented) to the Experts. Experts may prohibit any items that are not relevant to the execution of the task or that may give an unfair advantage to competitors.

9.4 Recommended Competition Area and Workstation Layout

(Note: Images from the original document are described below but not reproduced.)

Layout Diagram Description:
The layout shows a large rectangular "Technical Practice Area" in the center, surrounded by "Visitor Aisles". The practice area contains multiple rows of workstations. At the top of the diagram, there are areas designated as "Primary Encryption Area (6m8m)", "Secondary Encryption Area (6m8m)", "Technical Support Area (6m6m)", and "Equipment Area (6m6m)". At the bottom, there are areas for "Supervision and Arbitration", "Judges Area", and "Medical Area". Entrances/exits are marked on the left side.
Workstation Diagram Description:
A 3D rendering of a single workstation, including a desk, a desktop computer (monitor, keyboard, tower), and an office chair.

Venue Specifications:

- The total area of the competition zone should be no less than 300 m².
- The clear height should be no less than 3.5 m.
- Lighting, ventilation, ambient temperature, and humidity should be good and meet the equipment usage requirements, as well as the normal competition needs of the competitors.
- The main aisle in the competition area should be 2m wide, meeting emergency evacuation requirements.
- The venue shall provide stable water, electricity, and gas sources, as well as emergency power supply equipment. Security, police, firefighting, equipment maintenance, and power emergency personnel shall be on standby to prevent unforeseen events.
- The venue shall have public service areas such as maintenance services, medical stations, and living supply stations to serve competitors and staff.
- The competition units are relatively independent to ensure that competitors can compete independently without external interference. The competition area, including restrooms, medical points, maintenance service stations, living supply stations, and waste sorting and collection points, is within the cordon to ensure the competition is conducted in a relatively safe environment.

10. Skill-Specific Rules

Skill-specific rules cannot contradict or take precedence over the Competition Rules. They provide specific details and clarifications on various aspects that differ from one skill competition to another. They include, but are not limited to, personal computing devices, data storage devices, internet access, work procedures, and document management and distribution.

Topic/Task	Skill-Specific Rule
Use of Technology – USB, Memory Cards	Competitors may only use memory cards provided by the competition organizer. It is forbidden to take memory cards or any other portable storage devices out of the competition area. Memory cards or other portable storage devices must be handed over to the Chief Expert or Deputy Chief Expert for secure storage at the end of each day.
Use of Technology: Personal Laptops, Tablets, and Mobile Phones	Experts and interpreters may use personal laptops, tablets, and mobile phones. Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the competition area.
Use of Technology - Personal Cameras	Competitors, Experts, and interpreters may only use personal photo and video recording equipment in the workshop after the competition project is completed or with the consent of the Chief Expert.
Assessment of the Competition Project	For each workstation (module), the Chief Expert assigns a supervising expert with the highest level of professional expertise in that field. During the competitor's completion of the competition project, this expert controls OHS compliance and the completion or non-completion of competition project points, which can only be assessed during the competitor's task completion. The designated expert is fully responsible for the fairness of the competitor's assessment. If the competitor and expert at a workstation are from the same organization, the expert may be replaced once for the duration of the module.
Making 30% Changes in the Competition	During the introduction of the 30% changes (on

Project	day C-2), experts must perform the following work: - Update the task point descriptions regarding the equipment software and hardware features provided by the competition sponsor, based on the equipment and software provided (all modules).
Technical Problems for the Competitor During Task Completion	If a technical problem arises during the implementation of the competition project (not due to the competitor's fault), the competitor will be given extra time equal to the time from the discovery of the defect to its complete elimination. If the technical problem is found to be caused by the competitor's fault, the competitor will not be given extra time.
PPE (Personal Protective Equipment)	None.