

Artificial Intelligence Computer Vision Application



TECHNICAL DESCRIPTION

**Artificial Intelligence Computer Vision
Application (Offline)**

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1. Competition Name

Competition Name: Artificial Intelligence Computer Vision Application

2. Technical Description

(1) Event Description

The 2022 BRICS Skills Competition Artificial Intelligence Computer Vision Application Competition is designed according to the actual project needs, and is designed around the development trend of artificial intelligence computer vision and its core technologies. The assessment contents include: data cleaning, data processing, data set division, model construction, model optimization, model prediction, model preservation, etc. The competition module settings include: 'Requirements Document Analysis', 'Data Processing', 'Model Training and Prediction', etc.

(2) Basic Knowledge and Competency Requirements

1	Organization and Management	
	<p>Players need to know and understand:</p> <ul style="list-style-type: none">• Programs and practices that contribute to product sustainability• Solve problems and needs using existing tools• Choose the right plan among multiple plans, correct time estimation and allocation	Theory

	<p>Players should be able to :</p> <ul style="list-style-type: none"> • Consider feature deadlines and project deadlines • Ability to debug and handle errors within a limited time • Use of computer equipment, servers and software • Apply and research new technologies and skills according to industry development • Schedule work according to available time 	Practice
2	Requirements Document Analysis	
	<p>Players need to know and understand:</p> <ul style="list-style-type: none"> • Analyze model application scenarios according to specific project requirements • According to specific project requirements, describe the model building process and its considerations <p>Competitors should be able to :</p> <ul style="list-style-type: none"> • In-depth understanding of the background and core demands of the project • Master common deep learning models • Good writing and presentation skills, writing reasonable and readable documentation • Master the use of document writing tools, such as Word, Visio, etc. 	<p>Theory</p> <p>Practice</p>
3	Data Processing	
	<p>Players need to know and understand:</p> <ul style="list-style-type: none"> • Perform data processing according to specific project requirements and output data that meets model requirements <p>Players should be able to :</p>	<p>Theory</p> <p>Practice</p>

	<ul style="list-style-type: none"> • Use relevant digital image processing libraries to clean image datasets, such as removing abnormal images that cannot be loaded, deleting single-channel images, etc. Image processing libraries include PIL, OpenCv , NumPy, Scikit - image, SciPy, etc. • Use relevant digital image processing libraries to preprocess image datasets, such as image binarization, image enhancement processing, image noise reduction, etc. • Use the visualization library Matplotlib to analyze and visualize data sets, such as drawing line charts, column charts, pie charts, etc. 	
4	Model Training and Prediction	
	<p>Players need to know and understand:</p> <ul style="list-style-type: none"> • According to specific project requirements, conduct model training and prediction based on a given data set 	Theory
	<p>Players should be able to :</p> <ul style="list-style-type: none"> • Load and divide datasets according to task requirements • Build a model based on TensorFlow, use the training set for model training, and perform parameter tuning according to the training situation to make the model more effective • Use the visualization library Matplotlib to visualize the training process, such as loss value changes, accuracy changes, etc. • Use the trained model to predict the test data set, and calculate the accuracy, precision, recall, F1 value and other related indicators • Save the trained model locally 	Practice
5	Professionalism	

	<ul style="list-style-type: none"> Follow rules and regulations; dress decently; behave good manner. 	Theory
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3. Competition Items

This competition is closely combined with the strategic planning for the development of the new generation of artificial intelligence industry and the technological development direction of artificial intelligence in the field of computer vision, and is designed with the actual industrial application as the project background.

The total duration of this competition is 600 minutes, including four modules: "Requirement Document Analysis", "Data Processing", "Model Training and Prediction", and "Professional Quality". The works and source code submitted by the contestants in each module should have corresponding production specifications.

(1) Competition Task

Module	Task
Requirements Document Analysis	According to the model introduction in the requirement document, analyze the application scenarios of the model and the product positioning corresponding to the model, and write the model construction process and precautions.
Data	Use common image processing libraries for image data

Processing	<p>processing operations, including data cleaning, data preprocessing, and data visualization. The image processing libraries include PIL, OpenCv, NumPy, Scikit-image, SciPy, etc.; data cleaning includes removing abnormal image data, removing single-channel image data, removing duplicate image data, removing high similarity image data, removing blurred image data, etc.; image preprocessing operations include image binarization, image geometric transformation, image enhancement processing, image noise reduction, etc.; data visualization using the Matplotlib library to perform statistical analysis and visual display of the data set, and the visual charts include line graphs, histograms, pie graphs, scatter plots, etc.</p>
Model Training and Prediction	<p>According to specific project requirements, use TensorFlow to load and divide the data set; design the network structure of the image classification model and build the model; use the training set to train and save the model; record the loss value, accuracy rate and other indicators during the model training process, and draw the changes of the indicators; adjust the parameters according to the training situation to make the model better; select the appropriate model to save; use the test set data for model prediction; and print the model evaluation indicators.</p>

Professionalism	Follow rules and regulations; dress decently; behave good manner.
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(2) Competition Module

Module	Module Name	Duration (minute)	Point		Total
			Subjective	Objective	
A	Requirement Document Analysis	120	10	0	10
B	Data Processing	180	0	35	35
C	Model Training and Prediction+Professionalism	300	5	50	55
Total		600	15	85	100

(3) Mission Introduction

Example: An e-commerce company plans to develop a "search for the same item" system, which uses artificial intelligence computer vision application technology to extract image features from images taken or uploaded by users, and retrieves products with high similarity to image features from the product library. and recommend it to users.

(4) Module Introduction

1. Requirements Document Analysis

Model application analysis: According to the model introduction in the requirements document, describe the application scenarios of the model and the product positioning corresponding to the model.

Model construction process and precautions: Introduce the model construction process and precautions, including data collection, data processing, data loading, data set division, model training, model testing, model tuning, model saving, etc.

2. Data Processing

Image data cleaning: Use relevant digital image processing libraries to clean image datasets, such as removing abnormal images that cannot be loaded, removing single-channel images, removing duplicate image data, removing high-similarity image data, removing blurred image data, etc. Processing libraries include PIL, OpenCv, NumPy, Scikit-image, SciPy, etc.

Image preprocessing: Use related digital image processing libraries to preprocess image datasets, such as image binarization, image grayscale, image normalization, image geometric transformation, image enhancement processing, image noise reduction, etc.

Data visualization: Use visualization libraries to analyze and visualize data sets, such as drawing line charts, column charts, pie charts, etc.

3. Model Training and Prediction

Dataset loading and division: Load and divide datasets according to task requirements.

Model construction and training: Build a model based on the deep learning framework, input the training data set into the model for training, and perform parameter tuning according to the training situation to make the model more effective.

Training visualization: Use the visualization library to visualize the training process, such as changes in loss values, changes in accuracy, etc.

Model prediction: Use the trained model to predict the test data set, and calculate the accuracy, precision, recall, F1 value and other related indicators.

Model Saving: Save the trained model.

4. Professionalism

Follow rules and regulations; dress decently; behave good manner.

4. Competition Team Requirements

This competition is an individual competition. Teachers and students aged 16-35 in vocational colleges (including technical colleges) can participate as contestants. There is no gender restriction. Each team can be equipped with one expert.

5. Judging Rules

The grading work of the competition will be conducted in a unified way by online video conference. All experts are graded in groups under the organization of the chief expert .

If a player cheats or violates other rules during the competition, the referee will deal with the violation according to the player's violation. If the situations are serious, the score will be cancelled.

(1) Principles of Scoring Standards

The competition uses a combination of process scoring and result scoring, skill scoring and professional quality scoring to examine the overall quality of the contestants. At the same time, the scoring standards are formulated in the principle of "science-based, rigor, objectivity and fairness".

1. The full mark of the competition is 100 points.
2. In order to ensure the objectivity of the competition evaluation, we will formulate detailed scoring standards for each set of competition questions, refine the scoring items, quantify the scoring standards of each scoring item as much as possible, reduce the proportion of subjective judgments, and ensure the objectivity and fairness of the competition.

(2) Scoring Method

1. The competition will be graded by the scoring method of step-by-step scoring and accumulative total score. Scores are calculated separately between modules , and errors are not transmitted between modules.

2. Independent scoring principle. Before scoring, the referees will randomly draw lots into groups to avoid forming teams subjectively. Each referee group will

give scores independently according to the competition module. After scoring, the total score will be counted to ensure that the score evaluation is objective, rigorous and accurate.

3. During the competition, if the contestants have uncivilized behaviors such as disrupting the order of the field, interfering with the normal work of the referees and invigilators, the chief referee will deduct the corresponding points of the special project. If the circumstances are serious, the competition qualification of the player will be disqualified. The player has to exit the game immediately.

4. Contestants are not allowed to mark the results of the competition with the information of the participating team. If they are found, they will be disqualified for the award evaluation.

(3) Scoring Rules

Module	Weights	Inspection Point
Requirements Document Analysis	10%	According to the model introduction in the requirements document, analyze the application scenarios of the model and the product positioning corresponding to the model, and write the model construction process and precautions.
Data Processing	35%	Use common image processing libraries for image data processing operations, including data cleaning,

		<p>data preprocessing, and data visualization. The image processing libraries include PIL, OpenCv, NumPy, Scikit-image, SciPy, etc.; data cleaning includes removing abnormal image data, removing single-channel image data, removing duplicate image data, removing high similarity image data, removing blurred image data, etc.; image preprocessing operations include image binarization, image grayscale, image normalization , image geometric transformation, image enhancement processing, image noise reduction, etc.; data visualization using the Matplotlib library to perform statistical analysis and visual display of the data set. Visual charts include line charts, column charts, pie charts, scatter charts, and more.</p>
<p>Model Training and Prediction</p>	<p>50%</p>	<p>According to the specific project requirements, use the deep learning framework to load the data set and divide the data set; design the network structure of the image classification model and build the model; use the training set to train and save the model; and record the loss value and accuracy rate during the</p>

		model training process, and draw the changes of the indicators, adjust the parameters according to the training situation to make the model better; select the appropriate model to save; use the test set data for model prediction, and print the model evaluation indicators.
Professionalism	5%	Follow rules and regulations; dress decently; behave good manner.

6. Materials and Equipment

(1) Suggested Site and Workstation Layout

1) Competition Environment

The competition venue should be a ventilated and bright indoor venue, the clear height of the venue should not be less than 3.5m, and the lighting (greater than 500lux), lighting and ventilation should be ensured.

Each competition station is marked with the competition position number, and is equipped with 1 station and 1 equipment space, which is used to equip the software and hardware required by the competition platform and technical work, and each competition room is equipped with a workbench for placing computers, monitors, tools, etc.

Each workstation in the competition venue is equipped with an operating

platform and a 220-volt power supply, and the cables in the workstation should meet safety requirements.

A referee area is set up at the competition venue, and statistical tools such as computers are configured to record the entire process of each team's competition.

A service area is set up at the competition venue to provide maintenance services, medical care, living supplies and other service guarantees.

The technical support area provides competition-related equipment such as PCs and competition backup platforms for contestants.

2) Field Layout Requirements

According to the characteristics of this event, the competition venue includes the contestant area, the contestant rest area, the referee area, the technical support area, the scoring area, the recording area and the working area of the chief referee. Every station in the arena must be captured by live cameras.

(2) Software Inventory

1) The software and instructions to be installed on the competitor's computer are as follows:

Software	Description
Operating System	Windows 10 operating system
Intelligent Training Platform	Intelligent training platform
Document Editing Software	Microsoft Office
Google Chrome	V103+
Notepad++	V8.0+
Chinese Pinyin Input Method	/

7 - zip	V21.07+
draw.io Desktop Version	17.0+

2) The software and instructions to be installed on the competition platform are as follows:

Software	Description
Operating System	Ubuntu 18.04 LTS
PyCharm Community Edition	V2021+
Python	V3.6.0+
Chrome	V90+
ChromeDriver	V90+ (matches Chrome version)
Ms Office	V2016+
Matplotlib	V3.3.0+
NumPy	V1.16.0+
Pandas	V1.1.0+
TensorFlow	V2.2.0+
TensorBoard	V1.12.0+
Keras -Preprocessing	V1.1.0+
SciPy	V1.5.0+
Scikit-image	V0.17.0+
OpenCv	V4.5.0+
Scikit-Learn	V0.24.0+

(3) Materials and Equipment Prohibited in Skilled Areas

Competitors should be declared (shown) to the experts. Experts may prohibit the use of any item that is irrelevant to the performance of the mission or that may give a competitor an unfair advantage.