NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

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PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: ARTIFICIAL INTELLIGENCE ENGINEER

LEVEL: NTA 8

TABLE OF CONTENT

CONTENTS

ABBREVIATIONS ii

GLOSSARY OF TERMS iv

1.0. INTRODUCTION 1

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS 2

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR ARTIFICIAL INTELLIGENCE ENGINEERS 2

4.0. VALIDITY PERIOD 4

5.0. OCCUPATIONAL STANDARDS 4

5.1 OCCUPATIONAL STANDARDS FOR ARTIFICIAL INTELLIGENCE ENGINEER - NTA 8 5

TABLE 1: DACUM CHARTS FOR ARTIFICIAL INTELLIGENCE ENGINEER - NTA 8 37

ABBREVIATIONS

ANN	Artificial Neural Networks
AI	Artificial Intelligence
ASR	Automatic Speech Recognition
BERT	Bidirectional Encoder Representation from Transformer
CBET	Competency Based Education and Training
CNN	Convolutional Neural Networks
CV	Computer Vision
DL	Deep Learning
DRL	Deep Reinforcement Learning
ELMo	Embedding from Language Models
GAN	Generative Adversarial Networks
GPT	Generative Pre-trained Transformer
KG	Knowledge Graph
LSTM	Long Short-Term Memory
ML	Machine Learning
NACTVET	National Council for Technical and Vocational Education and Training
NLG	Natural Language Generation
NLP	Natural Language Processing
NOS	National Occupational Standards
OCR	Optical Character Recognition
OS	Occupational Standards

RL	Reinforcement Learning
RNN	Recurrent Neural Networks
TET	Technical Education and Training
TTS	Text-to-Speech
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.

Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training of Tanzania has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupational Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training Standards/Qualifications Standards are different. Occupational Standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs fault in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and Training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is critical that there must be a direct link between the Occupational Standards and the training standards to respond to demand of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the Occupational Standards. Occupational Standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant Occupational Standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Artificial Intelligence Engineer Occupation has its own set of occupational standards. The document explains how the Occupational Standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational Standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of experts and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The Occupational Standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, Supervisory Technicians on the job, and experienced Artificial Intelligence Engineers were key informants in the investigation to discover occupational trends. The information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ..... online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR ARTIFICIAL INTELLIGENCE ENGINEERS

These standards cover a broad range of duties and tasks that can be performed by Artificial Intelligence Engineers. However, the occupational standards are not meant to replace individual job

descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. Artificial Intelligence Engineers may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The job responsibilities of an Artificial Intelligence Engineer include AI application and development, algorithm research and optimization, data processing and mining, model construction and evaluation, system architecture design and debugging, technology innovation and project management, etc. At the same time, they must always keep abreast of the latest technological advances, as a full understanding of these advances is crucial for the continued development of their business. Generally, the Artificial Intelligence Engineer performs the following responsibilities:

a) Selection of AI algorithms

b) Implementation of AI algorithms

c) Optimization of AI algorithms

d) Application of AI algorithms

e) Management and operation of AI platforms

f) Development and analysis of natural language and speech processing requirements analysis report

g) Deployment of the technical architecture and business system of natural language and speech processing projects

h) Development and management of natural language and speech processing projects

i) Development and analysis of computer vision project requirements analysis reports

j) Training, inference, and deployment of basic computer vision algorithm model

k) Engineering of commonly-used hardware environments and tool chains using computer vision algorithms

l) Development and management of computer vision basics projects

m) Development and analysis of requirements analysis reports for AI application integration

n) Development of data analysis and processing methods

o) Development and management of AI application integration models

p) Completion of the integration test of AI related projects (products)

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA 7 and 8.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR ARTIFICIAL INTELLIGENCE ENGINEER - NTA 8

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ADAPTATION AND OPTIMIZATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	801
TASK TITLE	CONSTRUCTION AND OPERATION OF DEEP NEURAL NETWORK MODELS	**TASK NO.**	8011
PERFORMANCE CRITERIA	The person performing this task must be able to build and run deep neural network models in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. Computers; 2. System documents; 3. Integrated development environment (PyCharm, Visual Studio Code, etc.); 4. Data set (CIFAR-10, ImageNet, etc.); 5. Pre-processing tools (OpenCV, PIL, etc.); 6. Artificial intelligence engineer toolkit; 7. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Investigate applicable deep learning models; 2. Identify task requirements and constraints; 3. Select deep neural network models suitable for the tasks; 4. Prepare training set, verification set, test set and other data; 5. Define the network structure and layer connection; 6. Set parameters; 7. Build models; 8. Train the models, adjust the hyper-parameters and set the optimization algorithms; 9. Evaluate models.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select models; 1.2 Set hyper-parameters; 1.3 Pre-process data; 1.4 Train, evaluate, and optimize the models. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Basic principles of the convolutional neural network; 2.2 Basic principles of the recurrent neural network; 2.3 Relevant laws and regulations for data collection; 2.4 Commonly-used methods for pre-processing data. **3.0 Theories** The person performing this task must be able to explain the following:

	3.1 Methods of selecting deep learning neural network models; 3.2 Commonly-used methods for preparing data set; 3.3 Commonly-used methods for pre-processing data; 3.4 Methods for using and optimizing machine learning models; 3.6 Methods for using and optimizing deep learning models. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Neural network models are constructed and operated in accordance with technical standards, business requirements and operation manuals.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic concepts of machine learning; 2. Basic concepts of deep learning on neural networks; 3. Basic methods of data pre-processing.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ADAPTATION AND OPTIMIZATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	801
TASK TITLE	OPTIMIZATION OF AI MODELS OR ALGORITHM PARAMETERS	**TASK NO.**	8012
PERFORMANCE CRITERIA	The person performing this task must be able to conduct the adjustment to AI models or algorithm parameters in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Cloud computing platforms (Amazon Web Services, etc.); 6. Distributed computation clusters (Apache Spark, etc.); 7. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare training set, verification set, test set and other data; 2. Set initial parameters of the models; 3. Train the models with data; 4. Adjust parameters, such as the learning rates regularization terms, batch sizes, etc.; 5. Evaluate models, such as accuracy rates, recall rates, F1 scores, etc.; 6. Iterate optimization models; 7. Prepare optimization reports.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Select the ranges of initial parameters; 1.2 Balance computing resources with search space; 1.3 Determine the optimal parameter combinations; 1.4 Adjust model complexity. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Setting principles of individual mesh parameters in the neural networks; 2.2 Some optimization principles of neural networks. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Methods of selecting appropriate learning rates and iteration numbers; 3.2 Commonly-used methods of cross validation; 3.3 Implementation principles of grid search in the neural networks;

	3.4 Commonly-used methods for adjusting the model complexity. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.5 Interpersonal skills; 4.6 Teamwork skills; 4.7 Time management skills. **5.0 Math Skills** 5.1 Advanced mathematics/Calculus; 5.2 Linear algebra and matrix theory; 5.3 Probability theory and information theory; 5.4 Methods of optimization; 5.5 Graph theory/Discrete mathematics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Optimization of AI models or algorithm parameters are completed and the optimization reports are presented in accordance with technical standards and business requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Accuracy rates and recall rates; 2. AUC indicators and ROC curves; 3. Detection indicators; 4. Segmentation indicators.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	ADAPTATION AND OPTIMIZATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	801
TASK TITLE	TESTING OF AI MODELS OR ALGORITHMS	**TASK NO.**	8013
PERFORMANCE CRITERIA	The person performing this task must be able to test AI models or algorithms in the application scenarios in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Define the test objectives; 2. Prepare the data set; 4. Build deep learning framework models; 5. Train the models; 6. Verify the models; 7. Use the testing set to test models; 8. Analyse results and optimize parameters; 9. Record and share actual operation documents.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Identify tasks and data set; 1.2 Install the frameworks of machine learning and deep learning; 1.3 Carry out data pre-processing; 1.4 Train and test the models; 1.5 Deploy the models. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Core concepts and principles of deep learning and machine learning frameworks; 2.2 Vectorization, standardization and handling of missing value and extraction of its characteristics; **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Installation steps of machine learning and deep learning frameworks; 3.2 Commonly-used methods for pre-processing data; 3.3 Methods for evaluating the performance and

	accuracy of models. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills. **5.0 Math Skills** 5.1 Advanced mathematics/Calculus; 5.2 Linear algebra and matrix theory; 5.3 Probability theory and information theory; 5.4 Methods of optimization; 5.5 Graph theory/Discrete mathematics.
DESCRIPTION OF THE END PRODUCT / SERVICE	The test of AI models or algorithms are completed in accordance with the application needs and test documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic principles of the neural network; 2. Advantages and disadvantages of the basic frameworks; 3. Model transformation; 4. Applications or service of embedding models.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	IMPLEMENTATION AND APPLICATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	802
TASK TITLE	COMPLETION OF THE WHOLE PROCESS OF AI ALGORITHM FRAMEWORK INSTALLATION, MODEL TESTING, AND INFERENCE DEPLOYMENT	**TASK NO.**	8021
PERFORMANCE CRITERIA	The person performing this task must be able to complete the installation of deep learning and machine learning frameworks, and complete the whole process of model testing and inference deployment in the installed frameworks in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Install the frameworks of deep learning and machine learning; 2. Pre-process data; 3. Test models; 4. Deploy models; 5. Write test reports.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install the frameworks of machine learning and deep learning; 1.2 Test models; 1.3 Deploy the models; 1.4 Write test reports. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Core concepts and principles of deep learning and machine learning frameworks; 2.2 Vectorization, standardization and handling of missing value and extraction of its characteristics; **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Installation steps of machine learning and deep

	learning frameworks; 3.2 Commonly-used methods for pre-processing data; 3.3 Methods for evaluating the performance and accuracy of models. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Test report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The frameworks of deep learning and machine learning are installed, the models are tested and deployed and the testing reports are provided in accordance with the technical standards, technical manuals and test documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic principles of the neural network; 2. Basic frameworks; 3. Model transformation; 4. Applications or service of embedding models.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	IMPLEMENTATION AND APPLICATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	802
TASK TITLE	CONSTRUCTION OF THE NEURAL NETWORK MODELS	**TASK NO.**	8022
PERFORMANCE CRITERIA	The person performing this task must be able to build up neural network models using user interfaces and solve practical problems in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Import the required libraries and frameworks; 2. Define the structure of models; 3. Pre-process data; 4. Build up models through the user interfaces of deep learning and machine learning frameworks; 5. Set hyper-parameters; 6. Compile models; 7. Train models; 8. Evaluate models; 9. Optimize models.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install the frameworks of deep learning and machine learning, and conduct the pre-processing of data; 1.2 Use user interfaces to build up simple neural network models; 1.3 Select appropriate parameters to optimize models; 1.4 Compile, train, and evaluate models; 1.5 Optimize models. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Training and inference procedures of AI models; 2.2 Functions supported by AI frameworks; 2.3 Basic data types in the AI frameworks. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Commonly-used user interfaces for commonly-used frameworks of deep learning and machine learning; 3.2 Commonly-used methods for dividing data set;

	3.3 Setting methods of hyper-parameters. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The user interfaces are used to build the neural network model, and the module codes are provided in accordance with technical standards, application needs and technical manuals.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Accuracy rates and error rates; 2. Precision rates and recall rates; 3. F1 scores; 4. ROC curves and AUC.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	IMPLEMENTATION AND APPLICATION OF AI ALGORITHMS OR MODELS	**DUTY NO.**	802
TASK TITLE	UPGRADE AND VERIFICATION OF AI ALGORITHMS OR MODELS	**TASK NO.**	8023
PERFORMANCE CRITERIA	The person performing this task must be able to complete the upgrade and test of AI algorithms or models in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Understand the cutting-edge science and technology and theories; 2. Use different operating systems of computers to update the environment; 3. Update the frameworks of deep learning and machine learning; 4. Update AI algorithms or models; 5. Solve the compilation and running problems caused by updating environment and upgrading AI algorithms or models; 6. Test and update the AI algorithms or models in the background.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Understand the cutting-edge science and technology and theories; 1.2 Use common systems; 1.3 Update the methods of deep learning and machine learning frameworks; 1.4 Understand the solutions of common problems in compiling and running; 1.5 Write test reports. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Underlying implementation principles of neural networks; 2.2 Implementation principles of the frameworks of deep learning and machine learning; 2.3 Relevant theories of upgrading and testing of AI algorithms or models. **3.0 Theories** The person performing this task must be able to explain

	the following: 3.1 Construction of neural network infrastructure; 3.2 Relevant concepts of neural networks such as convolution kernel and pooling. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The upgrade and verification of AI algorithms or models are completed in accordance with technical manuals and test documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Four basic properties of neural networks; 2. Researches on biological prototype of neural networks; 3. Knowledge representations of artificial neural networks; 4. Principles of BP neural networks.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	DEVELOPMENT OF AI PRODUCTS	**DUTY NO.**	803
TASK TITLE	DEVELOPMENT OF AI PRODUCT REQUIREMENTS ANALYSIS REPORTS	**TASK NO.**	8031
PERFORMANCE CRITERIA	The person performing this task must be able to complete the development of AI product requirements analysis reports in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Customer demand lists; 3. Computers; 4. AI-related software tools; 5. Artificial intelligence engineer toolkit; 6. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	UNDERPINNING KNOWLEDGE
The person performing this task must be able to do the following: 1. Analyse product contexts and objectives; 2. List functional requirements of customers; 3. Determine the types, sources and scales of data required for the product; 4. Determine the technical requirements and constraints of the products; 5. Describe the design requirements for the user interfaces; 6. Define the performance indicators and requirements of systems; 7. Clarify product security and privacy requirements; 8. Plan the extensibility of projects; 9. Plan project scheduling and delivery requirements; 10. Analyzing product risks.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Conduct project requirements analysis and research; 1.2 Perform requirements modeling and analysis; 1.3 Perform the loops of iterations and feedbacks; 1.4 Conduct competitive product analysis and market research. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Requirement acquisition principles; 2.2 Measurability principles; 2.3 Requirement iteration principles. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Theories of AI algorithm training; 3.2 Theories of high performance computing; 3.3 Theories of parallel computation and distributed computation.

	4.0 Essential Skills 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Communication skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Leadership skills; 4.7 Project management skills; 4.8 Time management skills. **5.0 Math Skills** 5.1 Probability theory and information theory; 5.2 Methods of optimization; 5.3 Graph theory/Discrete mathematics.
DESCRIPTION OF THE END PRODUCT / SERVICE	AI product requirements analysis reports are developed in accordance with technical guidelines and user requirement documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic principles of the neural network; 2. Laws and ethics; 3. Project management.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	DEVELOPMENT OF AI PRODUCTS	**DUTY NO.**	803
TASK TITLE	RESEARCH AND CONSTRUCTION OF AI PRODUCT TECHNICAL ARCHITECTURE	**TASK NO.**	8032
PERFORMANCE CRITERIA	The person performing this task must be able to build up the construction of AI product technical architecture and form technical architecture documents in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Identify product requirements and constraints; 2. Identify the components of the products; 3. Define the interfaces of the products; 4. Design the logical and physical architecture of the products; 5. Evaluate and verify the architectural designs of products; 6. Prepare the technical architecture documents.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the constraints of the products; 1.2 Select the product architecture methods; 1.3 Break down the components of the systems; 1.4 Embed algorithms or models into products; 1.5 Design better technical architecture; 1.6 Evaluate and update technical architecture. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Concepts of the technical architecture of products; 2.2 Objectives of the technical architecture of products. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Advantages and disadvantages of the common architectural approaches of products; 3.2 Structured methods; 3.3 Common development models of products.

	4.0 Essential Skills 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.6 Teamwork skills; 4.6 Leadership skills; 4.7 Project management skills; 4.8 Time management skills. **5.0 Math Skills** 5.1 Advanced mathematics/Calculus; 5.2 Linear algebra and matrix theory; 5.3 Probability theory and information theory; 5.4 Methods of optimization; 5.5 Graph theory/Discrete mathematics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Technical architecture of AI products is constructed and technical architecture documents are output in accordance with the technical guidelines and specifications, and business requirement documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Styles of technical architecture; 2. Microservices architecture; 3. Lightweight architecture; 4. Nature of integration.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	DEVELOPMENT OF AI PRODUCTS	**DUTY NO.**	803
TASK TITLE	PREPARATION OF THE CODES OF AI PRODUCTS	**TASK NO.**	8033
PERFORMANCE CRITERIA	The person performing this task must be able to write artificial product codes in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select programming languages; 2. Install and configure the development environment; 3. Complete the basic functions of the product non-algorithms; 4. Install the frameworks of algorithms (models); 5. Implement algorithms (models) and provide the interfaces; 6. Embed algorithms (models) into products.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Install and configure the development environment; 1.2 Select the data transfer interfaces; 1.3 Explain abstractly solved problems; 1.4 Implement one or more algorithms (models); 1.5 Provide interfaces available for invocation; 1.6 Integrate codes to complete the functionality of projects. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Relevant theories to implement AI algorithms or models; 2.2 Ways to develop software. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Relevant technical requirements of code preparation; 3.2 Common data transmission interfaces. **4.0 Essential Skills** 4.1 Problem-solving skills;

	4.2 Critical thinking skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills. **5.0 Math Skills** 5.1 Advanced mathematics/Calculus; 5.2 Linear algebra and matrix theory; 5.3 Probability theory and information theory; 5.4 Graph theory/Discrete mathematics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Certain parts of the codes of artificial products are prepared in accordance with technical guidelines and business requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Basic theories of development; 2. Code preparation specifications; 3. Industry technical requirements.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	DEVELOPMENT OF AI PRODUCTS	**DUTY NO.**	803
TASK TITLE	TEST AND DELIVERY OF AI PRODUCTS	**TASK NO.**	8034
PERFORMANCE CRITERIA	The person performing this task must be able to test AI products and deliver AI projects in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Artificial intelligence engineer toolkit; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Test algorithms (models); 2. Perform integration tests of AI products; 3. Evaluate AI products; 4. Verify AI products; 5. Provide various delivery documents; 6. Deliver AI products.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Test algorithms (models); 1.2 Perform integration tests of AI products; 1.3 Feedback test results and suggest changes; 1.4 Write test reports; 1.5 Write relevant documents for product delivery; 1.6 Deliver AI products. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Delivery standards of AI products; 2.2 Development modes of AI products. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Testing methods of AI products; 3.2 Evaluation methods of AI products. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Communication skills; 4.3 Report writing skills;

	4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Project management skills; 4.7 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The test and verification of AI products are completed, and the AI projects are delivered in accordance with technical guidelines, test documents and delivered documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Industry standards of AI products; 2. Delivery standards of AI products.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	AI PROJECT MANAGEMENT	**DUTY NO.**	804
TASK TITLE	INSTALLATION AND UNLOADING OF BASIC AI PROJECT SOFTWARE	**TASK NO.**	8041
PERFORMANCE CRITERIA	The person performing this task must be able to install and unload AI project software in accordance with industry standards and national specifications.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. Software installation packages of products; 2. Installation and configuration manuals; 3. Computers; 4. AI-related software tools; 5. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare installation environment; 2. Install AI project software; 3. Debug AI project software; 4. Unload AI project software; 5. Observe health and safety precautions at work; 6. Keep the workplace clean; 7. Store tools properly.	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare installation environment, and install required dependencies and libraries; 1.2 Install AI project software; 1.3 Unload AI project software; 1.4 Upgrade AI project software; 1.5 Back up existing codes and data. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of installation environmental requirements for software in AI projects; 2.2 Operating principles of AI project software; 2.3 Backup and restoration principles of AI project software. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Operating environment of AI project software; 3.2 Installation, debugging, and unloading policies of the AI project software.

	4.0 Essential Skills 4.1 Skills of keeping learning and improving; 4.2 Problem-solving skills; 4.3 Critical thinking skills; 4.4 Analysis skills; 4.5 Interpersonal skills; 4.6 Teamwork skills; 4.7 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	AI project software is installed and unloaded in accordance with technical guidelines and project configuration documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Operating environment of AI project software; 2. Installation strategies of AI project software; 3. Debugging strategies of AI project software; 4. Unloading strategies of AI project software; 5. Maintenance and operating policies.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGEMENT OF NATURAL LANGUAGE AND SPEECH PROCESSING PROJECTS	**DUTY NO.**	804
TASK TITLE	CONFIGURATION AND USAGE OF AI PROJECT SOFTWARE	**TASK NO.**	8042
PERFORMANCE CRITERIA	The person performing this task must be able to complete the configuration and usage and upgrade of basic AI project software in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. Project technical documents; 2. Software installation packages of products; 3. Installation and configuration manuals; 4. Computers; 5. AI relevant toolkit; 6. Office software (e.g. Office).		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Configure the variables of documents or environment; 2. Set up the necessary model parameters, paths and database connections; 3. Adjust hyper-parameters, learning rate, etc. to optimize model performance; 4. Deploy model to the API, command line tools or applications of graphical interfaces in accordance with project requirements; 5. Check for project updates and dependency versions periodically; 6. Download the latest code or update files, and upgrade in accordance with the project documents; 7. Prepare project documents; 8. Observe health and safety precautions; 9. Keep the workplace clean;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Configure the variables of documents or environment; 1.2 Deploy model to the API, command line tools or applications of graphical interfaces; 1.3 Configure and deploy environment and servers. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of model optimization; 2.2 Principles of model deployment; 2.3 Principles of feature engineering. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Deep learning theories; 3.2 Reinforcement learning theories; 3.3 Generative model theories; 3.4 Semi-supervised model theories;

10. Store the tools.	3.5 Natural language processing theories. **4.0 Essential Skills** 4.1 Skills of keeping learning and improving; 4.2 Problem-solving skills; 4.3 Critical thinking skills; 4.4 Analysis skills; 4.5 Interpersonal skills; 4.6 Teamwork skills; 4.7 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The AI project software is configured and used in accordance with technical guidelines and project configuration documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Programming languages and frameworks 2. Machine learning and deep learning algorithms. 3. Model evaluation and validation; 4. Feature engineering.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	AI PROJECT MANAGEMENT	**DUTY NO.**	804
TASK TITLE	DEVELOPMENT OF IMPLEMENTATION PLANS OF THE AI PROJECTS	**TASK NO.**	8043
PERFORMANCE CRITERIA	The person performing this task must be able to develop implementation plans of the AI projects in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. Office software (e.g. Office); 2. Computers; 3. AI-related software tools.		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Define project objectives and scopes; 2. Analyse the features, distribution and correlation of project data; 3. Extract the feature quantity of the project data; 4. Optimize algorithms and parameters in the projects; 5. Update model parameters iteratively; 6. Optimize model performance; 7. Check whether the project meets the expected goals and requirements; 8. Deploy projects and ensure the performance, stability and security of the projects; 9. Observe health and safety precautions; 10. Keep the workplace clean; 11. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Perform data cleaning; 1.2 Extract features; 1.3 Conduct cross validation; 1.4 Conduct overfitting and underfitting processing; 1.5 Conduct model deployment and integration; 1.6 Iterative optimizations. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Principles of algorithm development; 2.2 Principles of code writing; 2.3 Principles of project testing; 2.4 Principles of test specifications; 2.5 Databases and storage technologies. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 Project validation and delivery technologies; 3.2 Project validation and the use of delivery tools; 3.3 Project validation and delivery methods.

	4.0 Essential Skills 4.1 Problem-solving skills; 4.2 Communication skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Project management skills; 4.7 Time management skills; 4.8 Leadership skills; 4.9 Critical thinking.
DESCRIPTION OF THE END PRODUCT / SERVICE	Implementation plans of AI projects are completed in accordance with technical guidelines and specifications and business requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Data analysis and processing; 2. Code preparation specifications; 3. Project testing strategies.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	AI PROJECT MANAGEMENT	**DUTY NO.**	804
TASK TITLE	DEVELOPMENT AND IMPLEMENTATION OF AI PROJECT OPERATION AND MAINTENANCE PLANS	**TASK NO.**	8044
PERFORMANCE CRITERIA	The person performing this task must be able to develop and complete basic daily operation and maintenance of AI projects in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. Office software (e.g. Office); 2. Project technical instructions; 3. Computers; 4. AI-related software tools.		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check data quality and update data regularly; 2. Test the model performance and optimize the models; 3. Monitor the stability of systems; 4. Write daily operation and maintenance plans; 5. Complete the maintenance and upgrade of AI projects; 6. Prepare operation and maintenance process, relevant specifications and manuals related to projects; 7. Observe health and safety precautions; 8. Keep the workplace clean; 9. Store the tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Read and interpret various operation and maintenance scripts; 1.2 Understand the operation and maintenance knowledge of databases and installation, configuration and optimizing methods of each middleware; 1.3 Draft project operation and maintenance plans; 1.4 Explain the using methods of various open source tools in communities; 1.5 Show the operation and maintenance plans. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Operating principles of AI projects; 2.2 Principles of data management; 2.3 Principles of model management; 2.4 Principles of system management; 2.5 Principles of continuous improvement. **3.0 Theories** The person performing this task must be able to explain

	the following: 3.1 System operation and security theories; 3.2 System monitoring and maintenance; 3.3 Version control theories. **4.0 Essential Skills** 4.1 Problem-solving skills; 4.2 Critical thinking skills; 4.3 Communication skills; 4.4 Report writing skills; 4.5 Teamwork skills; 4.6 Leadership skills; 4.7 Project management skills; 4.8 Time management skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	AI project operation and maintenance plans are developed and performed in accordance with technical standards and configuration documents.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Server and infrastructure management; 2. Database management; 3. Networks and security; 4. Scripting and programming skills; 5. Log and monitoring management; 6. Fault processing and optimization; 7. Quality assurance and document processing; 8. Project operation and maintenance strategies.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	PROVISION OF CONSULTING AND EVALUATION SERVICES FOR AI PROJECTS	**DUTY NO.**	805
TASK TITLE	IMPLEMENTATION OF TECHNICAL CONSULTING FOR AI PROJECTS	**TASK NO.**	8051
PERFORMANCE CRITERIA	The person performing this task must be able to perform technical consulting services of AI platform projects in accordance with the development of new technology in the industry, industry standards and national specifications.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Plan the direction of AI platforms; 2. Use modern engineering methods to conduct corresponding AI consulting services; 3. Write project proposals; 4. Write project demonstration reports; 5. Write feasibility study reports; 6. Write implementation plans; 7. Provide implementation guidance and follow-up technical support; 8. Keep the workplace clean; 9. Standardize the storage tools.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Plan the direction and development strategies of AI platforms; 1.2 Consult related services using modern engineering consulting methods; 1.3 Write consulting documents related to AI projects; 1.4 Evaluate the strengths, weaknesses and adaptability of different AI technologies and algorithms; 1.5 Guide the implementation of AI projects. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Operating principles of AI platforms; 2.2 AI platform implementation planning. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 AI platform development; 3.2 AI platform upgrade planning; 3.3 AI platform implementation schemes.

	4.0 Essential Skills 4.1 Problem-solving skills; 4.2 Communication skills; 4.3 Report writing skills; 4.4 Interpersonal skills; 4.5 Teamwork skills; 4.6 Time management skills. 4.7 Critical thinking.
DESCRIPTION OF THE END PRODUCT / SERVICE	Technical consulting for AI projects is completed in accordance with technical guidelines and user requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Document preparation knowledge; 2. Engineering consulting methods; 3. System analysis theories; 4. AI ethical knowledge and safety knowledge; 5. Privacy protection knowledge.

OCCUPATION	ARTIFICIAL INTELLIGENCE ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	PROVISION OF CONSULTING AND EVALUATION SERVICES FOR AI PROJECTS	**DUTY NO.**	805
TASK TITLE	IMPLEMENTATION OF TECHNICAL EVALUATION FOR AI PROJECTS	**TASK NO.**	8052
PERFORMANCE CRITERIA	The person performing this task must be able to implement technical evaluations of AI projects in accordance with industry standards and national norms.		
RANGE STATEMENT	The task can be performed in the office place under the supervision of artificial intelligence engineers. The tools and equipment to be used include: 1. System documents; 2. Computers; 3. AI-related software tools; 4. Office software (e.g. Office).		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Monitor project schedule and implementation; 2. Construct the evaluation indicator systems of AI projects; 3. Evaluate AI projects using different evaluation methods; 4. Interpret and evaluate the experimental results in accordance with different experimental designs of the projects; 5. Improve the models; 6. Prepare project evaluation reports.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Establish and improve evaluation systems; 1.2 Design reasonable evaluation indicators; 1.3 Develop reasonable experiment schemes and design control variables; 1.4 Analyse and optimize experimental results; 1.5 Prepare corresponding evaluation and analysis reports. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Technical principles of AI projects; 2.2 Technical architecture of AI projects; 2.3 Scheme design principles of AI projects; 2.4 AI project implementation planning; 2.5 Frameworks of AI evaluation indicator systems; 2.6 AI experimental verification principles. **3.0 Theories** The person performing this task must be able to explain the following: 3.1 AI project evaluation theories;

	3.2 AI project evaluation research theories; 3.3 AI test experimental theories; 3.4 AI ethics. **4.0 Essential Skills** 4.1 Communication, reporting and writing skills; 4.2 Problem analysis and solving skills; 4.3 Solution development skills; 4.4 Project leadership skills; 4.5 Project development skills; 4.6 Time management skills; 4.7 Report writing skills; 4.8 Interpersonal skills. **5.0 Math Skills** 5.1 Statistics; 5.2 Linear algebra; 5.3 Advanced mathematics; 5.4 Probability theory and mathematical statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Technical evaluation for AI projects is completed in accordance with technical guidelines and user requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. AI ethical knowledge and safety knowledge; 2. System planning knowledge; 3. Software architecture framework evaluation knowledge; 4. Social evaluation methods; 5. Privacy protection knowledge.

TABLE 1: DACUM CHARTS FOR ARTIFICIAL INTELLIGENCE ENGINEER - NTA 8

DUTIES	TASKS	ENABLERS
1.0 Adaptation and optimization of AI algorithms or models	1.1 Construction and operation of deep neural network models. 1.2 Optimization of AI models or algorithm parameters. 1.3 Test of AI models or algorithms.	**General skills and knowledge** · Learning and research skills · Innovation skills · Basic skills of operating system · Basic skills of programming language · Communication and report writing skills · Analysis skills · Problem-solving skills · Teamwork skills · Work ethic **Tools and equipment** · Computers · Integrated development environment (PyCharm, Visual Studio Code, etc.) · Pre-processing tools (OpenCV, PIL, etc.) · Artificial intelligence engineer toolkit · Cloud computing platforms (Amazon Web Services, etc.) · Distributed computation clusters (Apache Spark, etc.) · Office software (e.g. Office) **Materials** · Data · System documents **Requirements for employees** · Teamwork · Time management · Patience and confidence
2.0 Implementation and application of AI algorithms or models	2.1 Completion of the whole process of AI algorithm framework installation, model testing, and inference deployment. 2.2 Construction of the neural network models. 2.3 Upgrade and verification	**General skills and knowledge** · Learning and research skills · Innovation skills · Basic skills of operating system · Basic skills of programming language · Communication and report writing skills

DUTIES	TASKS	ENABLERS
	of AI algorithms or models.	· Analysis skills · Problem-solving skills · Work ethic **Tools and equipment** · Computers · AI relevant software tools · Artificial intelligence engineer toolkit · Office software (e.g. Office) **Materials** · Data · System documents **Requirements for employees** · Teamwork · Time management · Patience and confidence · Communication skills · Learning skills
3.0 Development of AI products	3.1 Development of AI product requirements analysis reports. 3.2 Research and construction of AI product technical architecture. 3.3 Preparation of the codes of AI products. 3.4 Test and delivery of AI products.	**General skills and knowledge** · AI environment configuration skills · Computer networks skills · Hardware skills · Essential skills of script languages · Model deployment skills · Algorithms application skills · Skills to apply machine learning theories · Communication, report writing and analysis skills · Problem analysis and solving skills · Time management skills · Project management skills **Tools and equipment** · Computers · System documents · Remote access tools · Database management tools · AI relevant software tools · Artificial intelligence engineer toolkit

DUTIES	TASKS	ENABLERS
		· Office software (e.g. Office) **Materials** · Configuration documents · Software installation packages **Requirements for employees** · Time management · Teamwork · Code preparation
4.0 AI project management	4.1 Installation and unloading of basic AI project software. 4.2 Configuration and usage of AI project software. 4.3 Development of implementation plans of the AI project. 4.4 Development and implementation of AI project operation and maintenance plans.	**General skills and knowledge** · Server configuration · Basic programming skills · Skills of keeping learning and improving · Model evaluation and validation · Integration test skills · Problem-solving skills · Interpersonal communication skills · Moral skills **Tools and equipment** · Project technical documents · Computers · Remote access tools · Database management tools · AI relevant toolkit · Office software (e.g. Office) **Materials** · Data · Installation and configuration manuals · Project technical instructions · Code writing guidance · Software installation packages of products **Requirements for employees** · Time management · Teamwork · Writing specifications · Project deployment skills

DUTIES	TASKS	ENABLERS
		· Fault analysis skills
5.0 Provision of consulting and evaluation services for AI projects	5.1 Implementation of technical consulting for AI projects. 5.2 Implementation of technical evaluations for AI projects.	**General skills and knowledge** · Project consulting skills · Communication, reporting and writing skills · Problem analysis and solving skills · Solution development skills · Project leadership skills · Skills to implement AI confirmatory experiments · Track of the development trends of new technologies in applications and projects · Project development skills · Time management skills · Application integration analysis skills **Tools and equipment** · Computers · Remote access tools · Database management tools · Office software (e.g. Office) · AI relevant software tools **Requirements for employees** · Time management · Teamwork · Writing specifications