



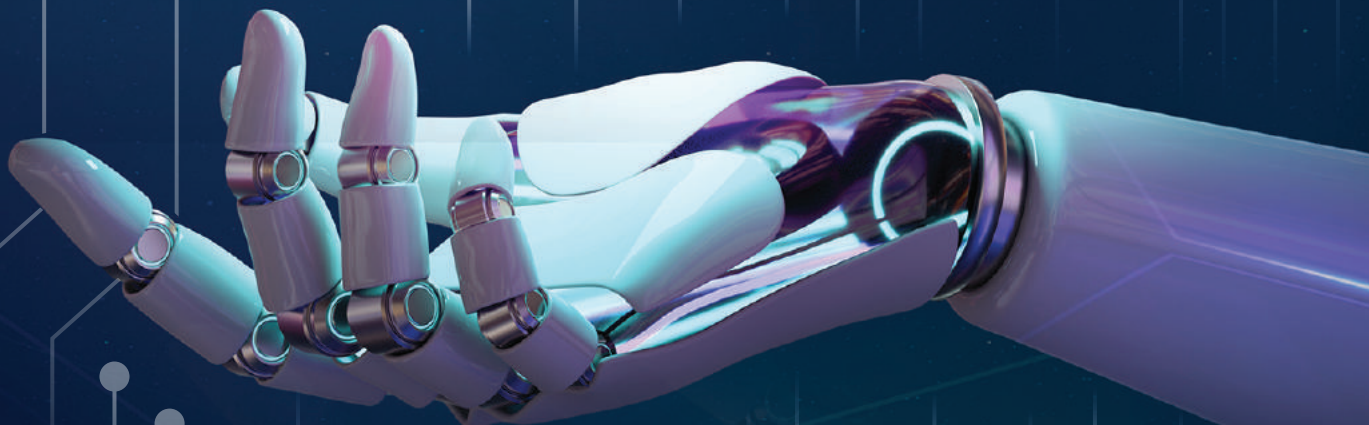
PERKESO



EMPLOYMENT INSURANCE SYSTEM

LEVERAGING ARTIFICIAL INTELLIGENCE IN BRIDGING OCCUPATIONS AND QUALIFICATIONS

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Prepared by Employment Information Analysis Services (EIAS)

1. Introduction

Matching occupations with qualifications is tedious and mundane, especially when the total number of defined occupations in the Malaysian Skills, Occupation and Competences (MSOC) list is in the thousands. MSOC is a standard taxonomy that defines the number of unique occupations, each complete with Description, Essential Skills, and Essential Knowledge required. The initial challenge is to develop a framework in matching every occupation with the qualifications approved by Malaysian Qualifications Agency (MQA) and Jabatan Pembangunan Kemahiran (JPK). The Essential Skills for each occupation is analysed with the similar metrics used by MQA and JPK to measure the qualification competences. In this case, MQA defines the qualification for each academic programme based on the Malaysian Qualification Registry (MQR), and JPK defines the qualifications for each National Occupational Skills Standard (NOSS) programme based on the Competences Units (CU). Using Artificial Intelligence (AI) to evaluate these parameters has made the matching possible with good accuracy and precision. The bridging occupations and qualifications framework aims to facilitate a good communication between supply and demand of the Malaysian labour market.

In this article, the matching between occupations and qualifications of the NOSS qualifications under the purview of JPK is discussed. There will be a series of article to discuss other frameworks that utilize AI that encompass the bridging occupations and qualifications sphere.



2. Closer Look at the MSOC Occupations and NOSS Qualifications

There are over 1,200 occupations listed as active in the MYFutureJobs portal¹, out of the total 2,942 defined in MSOC.² The MSOC occupations follows the ESCO classification where the detailed occupation titles are defined.

The example of MSOC occupation is as shown in Table 1:

Label	Code	Description	Essential Skills
accountant	2411.1	Accountants review and analyse financial statements, budgets, financial reports, and business plans in order to check for irregularities resulting from error or fraud, and provide their clients with financial advice in matters such as financial forecasting and risk analysis. They may audit financial data, resolve insolvency cases, prepare tax returns and provide other tax-related advice in reference to current legislation.	bankruptcy trustee budget analyst financial auditor audit supervisor financial controller cost analyst public finance accountant tax advisor financial fraud examiner dividend analyst accounting analyst grants management officer

Table 1.

The accountant occupation has a MSOC code 2411.1, with 12 Essential Skills listed. The list is in no order of importance to the occupation of the *accountant*.

There are more than 1,900 NOSS qualifications with varying levels from 1 to 5, with Level 5 representing the highest level of skills competences³. The CU Title column details the Competency Units required for the respective NOSS qualification (NOSS Code & NOSS Name).

The example of NOSS qualifications for Level 3, 4 & 5 *perakaunan* is as shown in Table 2:

NOSS Code	NOSS Name	CU Code	CU Title
FB-100-3:2012	perakaunan	FB-100-3:2012-C01	accounts payable
		FB-100-3:2012-C02	accounts receivable
		FB-100-3:2012-C03	payroll
		FB-100-3:2012-C04	cash and bank transactions
		FB-100-3:2012-C05	property, plant and equipment(ppe) register
		FB-100-3:2012-C06	month end financial statement
FB-100-4:2012	perakaunan	FB-100-4-2012-C01	property, plant and equipment (ppe)
		FB-100-4-2012-C02	financial report
		FB-100-4-2012-C03	hire purchase
		FB-100-4-2012-C04	business entities reporting
		FB-100-4-2012-C05	product costing

FB-100-5:2012	perakaunan	FB-100-5:2012-C01	financial information system (fis)
		FB-100-5:2012-C02	financial analysis
		FB-100-5:2012-C03	budgeting and cost control
		FB-100-5:2012-C04	audit submission
		FB-100-5:2012-C05	tax submission
		FB-100-5:2012-C06	internal control development

Table 2.

In the NOSS *perakaunan* qualification, there are 3 levels, ranging from 3 to 5, with each level has its set of Competency Units to be achieved for minimum qualification.

Matching the occupation and qualification is just a case of comparing each element in the Essential Skills and CU Title using AI, in which a similarity score is used to judge a match is completed.

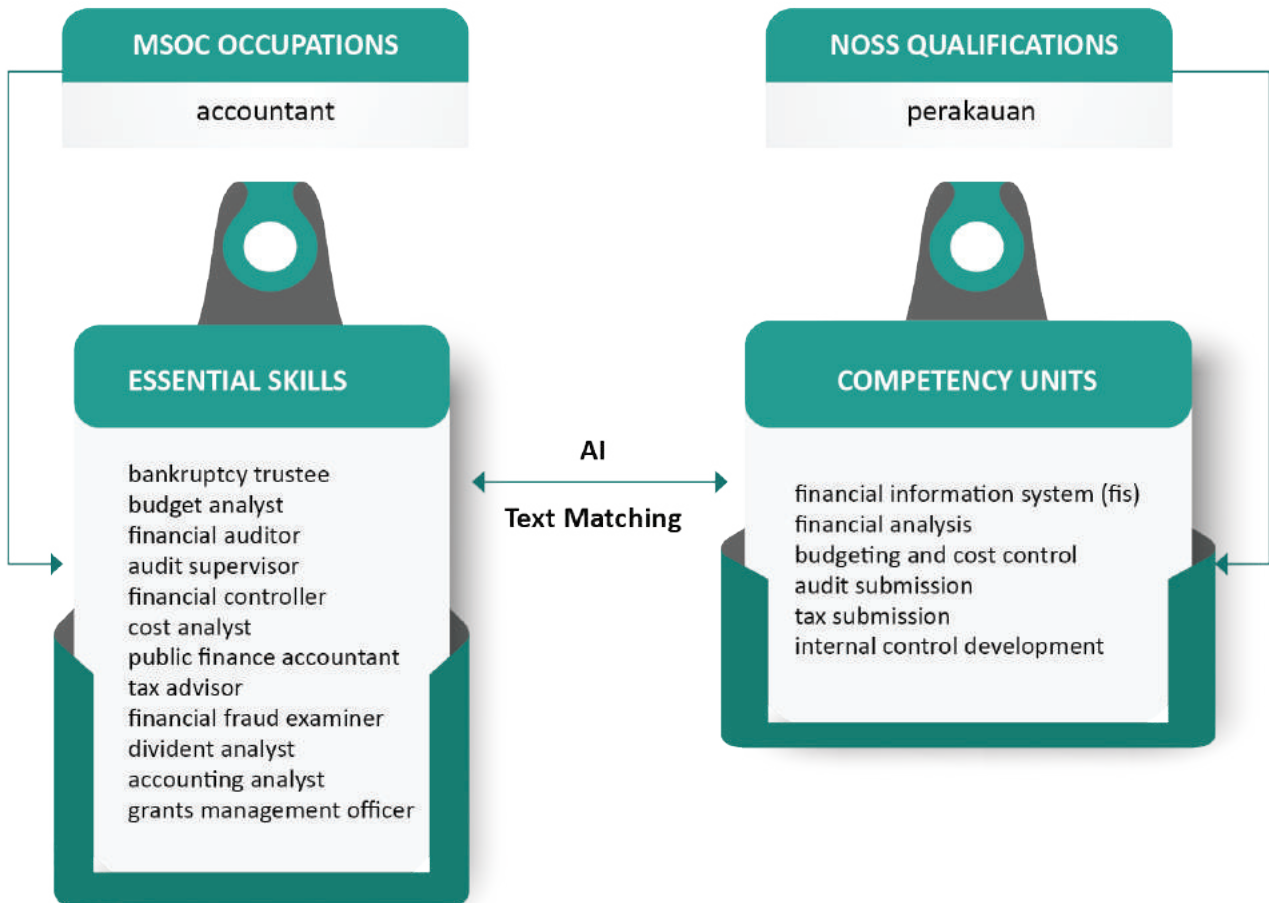


Figure 1.

¹ <https://www.myfuturejobs.gov.my/>

² <https://ec.europa.eu/esco/portal/occupation>

³ <https://www.myspike.my/index.php?r=umum-noss%2Findex-noss>

3. Closer Look at the MSOC Occupations and NOSS Qualifications

By looking at the structure of the sentences in describing the Essential Skills and Competency Unit (Figure 1), we can observe that MSOC uses the predicated sentence structure; whereas, the CU Title do not exhibit similar structure. The probability to obtain high accuracy in text matching using AI is the real challenge in this exercise. The algorithm's accuracy used to do the text matching can be sensitive to these situations:

- The optimal length of the sentence should be between 3 to 5 words, longer sentences reduces the accuracy
- The accuracy of Malay translations in certain qualifications' CU Title; however, it is less than 5% of the NOSS list
- The use of general skills to describe a particular CU Title can mislead the text matching to be out of context
- The use of short-forms and acronyms in CU Title cannot be properly matched with Essential Skills

The EIAS team in EIS uses Natural Language Processing (NLP) techniques in Python to analyse the text descriptions of each Essential Skills and each Competency Unit by forming a matrix of scores in a scale from 0 to 100. The higher score signifies the matching is achieved; whereas, the lower score suggests otherwise. The cut-off score to accept the matching is set to 60. Table 3 shows the NOSS qualifications with the corresponding occupations matched with the scores.

EE-037-4:2012: packet switch core network engineering	Score
telecommunications engineering technician	80
telecommunications engineer	70
pastry chef	62
chef	55
cook	55
accountant	47
welder	47
accounting assistant	43
FB-100-5:2012: perakaunan	Score
accountant	67
accounting assistant	67
chef	55
cook	55
telecommunications engineering technician	53
telecommunications engineer	50
welder	46
pastry chef	44

HT-012-3:2012: penyediaaan & pembuatan makanan	Score
chef	79
pastry chef	79
cook	79
telecommunications engineering technician	56
accountant	51
accounting assistant	51
welder	47
telecommunications engineer	47
HT-013-4:2012: pengurusan pastri & roti	Score
pastry chef	69
chef	68
cook	68
welder	47
telecommunications engineer	45
telecommunications engineering technician	44
accounting assistant	41
accountant	39
MC-027-3:2012: proses kimpalan arka berteras logam	Score
welder	56
accountant	39
pastry chef	38
accounting assistant	38
telecommunications engineer	38

Table 3.

In most cases, the text matching algorithm managed to identify the corresponding occupations with its related qualification. It is important to observe these cases:

- In the **EE-037-4:2012: packet switch core network engineering** NOSS qualification, the occupation *pastry chef* has a score of 62 which is more than the cut-off point. This is a False Positive assessment.
- In the **MC-027-3:2012: proses kimpalan arka berteras logam** NOSS qualification, the occupation *welder* has a score of 56 which is less than the cut-off point. This is a False Negative assessment.

Both of these examples show both types of False assessments by the text matching algorithm. Upon investigation, it is noted that:

- In the case of the *pastry chef*, the CU Title uses at least one very common/general skill.
- In the case of the *welder*, the CU Title uses acronyms and very specialized words, as shown in Figure 2.

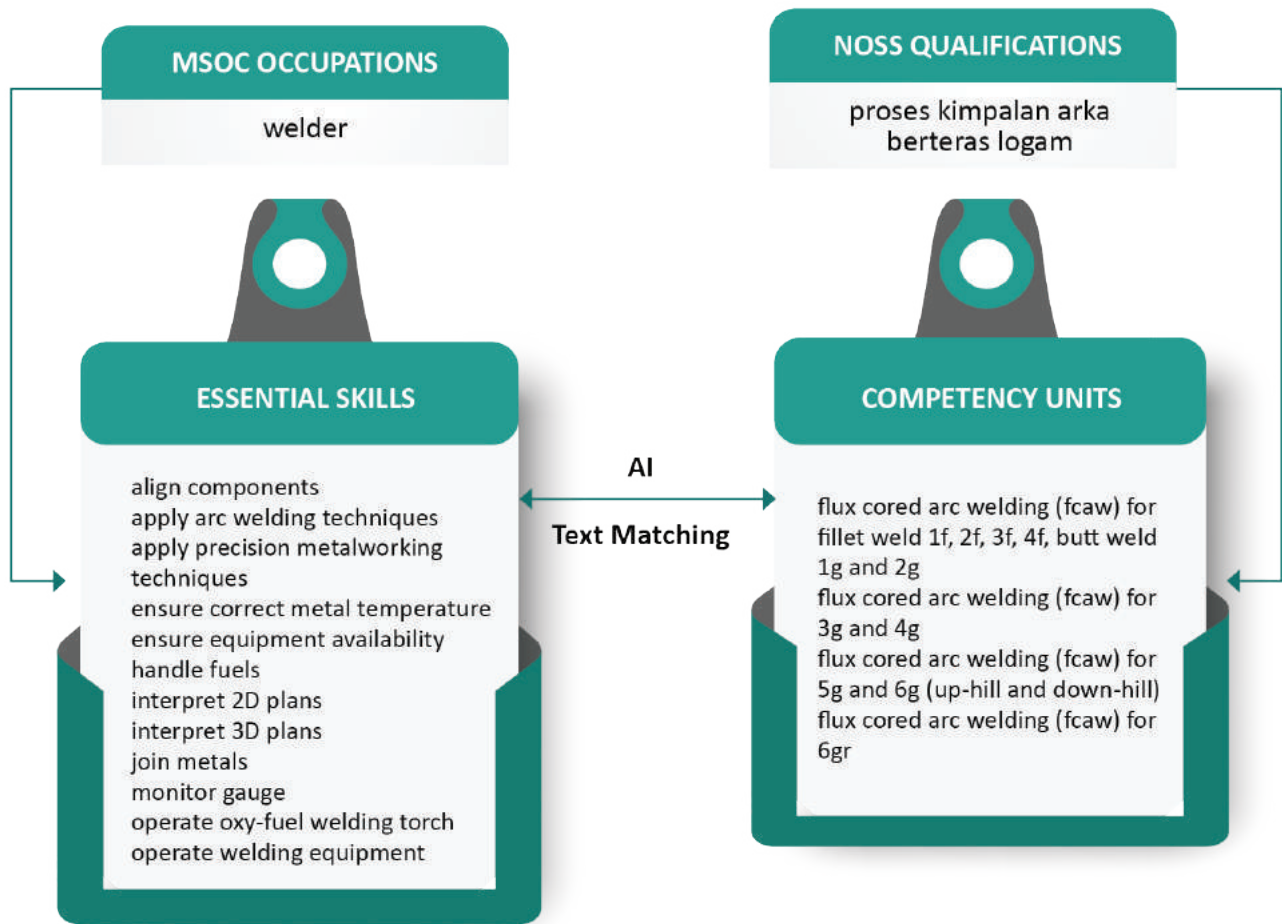


Figure 2.

For readers who are interested in the AI performance scores (geeks). Higher F1 Score signifies a better AI performance.

Measure	Cut-off 60 points	Cut-off 70 points
Sensitivity	71%	46%
Precision	59%	73%
F1 Score	64%	56%
Accuracy	89%	90%

To mitigate the potentially higher False matches, the EIAS team members further classify the occupations and qualifications based on groups and levels, respectively. MSOC uses 9 occupation groups, as defined by the International Labour Organization (ILO) using the ISCO-08 classification; NOSS uses 5 qualification groups based on skill levels. The matching is paired based on the matrix of the 9 occupation groups and 5 qualification levels.

4. Outcome from the Artificial Intelligence Text Matching

With the use of AI to assess the Essential Skills and Competency Unit for each occupation and qualification, the bridging exercise has been duly completed in the shortest time possible. Table 5 summarizes the outcome of the exercise.

Total of NOSS Qualifications Matched with MSOC Occupations					
MSOC/NOSS	Level 5 (314)	Level 4 (322)	Level 3 (711)	Level 2 (292)	Level 1 (121)
1. Managers	186	x	x	x	x
2. Professionals	111	106	x	x	x
3. Technicians and Associate Professionals	267	298	589	x	x
4. Clerical Support Workers	31	109	105	26	x
5. Services and Sales Worker	40	46	100	21	x
6. Skilled Agricultural, Forestry and Fishery Workers	20	22	27	25	10
7. Craft and Related Trades Worker	60	63	176	162	78
8. Plant and Machine Operators and Assemblers	15	15	65	22	9
9. Elementary Occupations	x	x	x	36	24

Table 5.

5. Evaluating the Artificial Intelligence Approach in the Labour Market Framework

The application of artificial intelligence to conduct text matching analysis for the bridging of the occupations and qualifications has showcased the potential of artificial intelligence to be implemented in other applications in the labour market framework. EIAS will be working on deploying more artificial intelligence approaches in harnessing and bridging any gaps in the major aspects of the labour market. Among the possible applications of artificial intelligence include:

- Job matching with Recommender System based on location, occupation and qualification
- Salary prediction with Deep Learning algorithm based on years of working experience, salary, occupation and qualification
- Career progression for PMET group with Deep Learning algorithm based on occupation and qualification
- Skills matching with Deep Learning for hiring expatriates and foreign labour based on location, occupation, qualification and salary
- Location-based matching with Deep Learning to identify sunrise/sunset labour market trends based on occupation and qualification

This article explained how EIAS is leveraging artificial intelligence through occupation and qualification bridging to enrich the occupations pillar. By doing so, it is pivotal for the outcomes to be used by policy makers to harness new ways to reduce the skills mismatch within the workforce. From this exercise, EIAS has learned a few things on the capabilities of artificial intelligence, and EIAS will be exploring new approaches to identify insights within the labour market.

The EIAS Division analyses labour market information from a variety of sources. The reports they produce are used to evaluate the efficiency of EIS services and to recommend changes to government policy regarding employment enhancement and the reduction of long-term unemployment. EIAS also manages the Malaysian Skills Occupation Qualification and Competences (MSOC) system for taxonomy purposes.

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