Research 2: Study of the labor market in the field of applied AI:

the state-of-the-art analysis for WP2

Date
15.09.2021

Places of the development of the result
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University of Library Studies and Information Technologies, Sofia, Bulgaria
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Summary: This questionnaire is a part of the research in connection with the objectives of project 2022-1-PL01-KA220-HED-000088359 "The Future is in Applied Artificial Intelligence" (FAAI) under the Erasmus + program. This project aims to join together Universities, and businesses and provide innovative solutions to develop AI experts. The questions in this study aimed to research the needs and expectations of business organizations to propose training specialists in the field of Applied AI. Please review the offered training courses in Applied AI and describe them. All fields are mandatory. Project site: http://faai.ath.edu.pl/0.

Keywords: applied AI, training courses

1. Introduction

Applied AI is a very important field when it comes to the labor market. There are a lot of possibilities that AI can be used in this area.

AI can automate routine and repetitive tasks, allowing humans to focus on more complex and creative work. This can increase productivity and efficiency, which is particularly important in industries where time is a critical factor, such as manufacturing or logistics. AI can reduce labor costs by automating certain tasks, reducing the need for human labor. This can be particularly beneficial for industries with high labor costs, such as healthcare and retail. It can improve decision-making. AI can help businesses make better decisions by analyzing vast amounts of data and identifying patterns and insights that humans may miss. This can be particularly useful in industries such as finance, where accurate and timely decision-making is critical. AI can create new business opportunities by enabling companies to develop new products and services, or to enter new markets. For example, AI-powered language translation technology has enabled companies to expand into new geographic regions.

Overall, AI is an important technology that can help businesses improve efficiency, reduce costs, make better decisions, and create new opportunities. While there are certainly concerns about the impact of AI on jobs, it is also clear that AI has the potential to create new jobs and industries, particularly in the fields of data science, machine learning, and robotics.

This survey was carried out in the context of project no. 2022-1-PL01-KA220-HED-000088359 entitled "The Future is in Applied Artificial Intelligence". Answers were obtained by searching and analyzing the job offers in the field of artificial intelligence. The questionnaire was performed on-line, using google forms-like tools.

The job offers were selected randomly from the advertising sites. The web sites were selected based on popularity and number of references. The survey data were presented in a quantitative form. The data was aggregated to the category based on syntactic analysis i.e., the difference in form and not meaning. The questions in this study aim to research the needs and expectations of business organizations and to create a profile of a specialist in the field of Artificial Intelligence.

2. Collection and analysis of data

The data was acquired by five partner institutions scientists:
- UBB - University of Bielsko-Biala, Bielsko-Biala, Poland
- ULSIT - University of Library Studies and Information Technologies, Sofia, Bulgaria
- UNi - University of Nis, Serbia
- USCM - University of Ss. Cyril and Methodius in Trnava, Slovakia
- UoM - University of Montenegro, Montenegro

UBB, UNi, USCM, UoM researchers collected 15 surveys, while researchers from ULSIT provided 14 surveys.

In total, 74 questionnaires were collected by 10 researchers.

3. Results

3.1. Position offered

Data description:

The first question of the survey asks what job position is offered. There were no specific restrictions regarding the nature of the job position. The results for this question are represented below, in Figure 1.

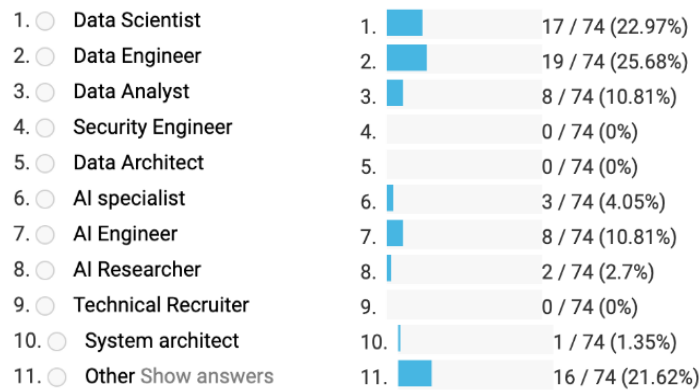|		
1. Data Scientist	1.	17 / 74 (22.97%)
2. Data Engineer	2.	19 / 74 (25.68%)
3. Data Analyst	3.	8 / 74 (10.81%)
4. Security Engineer	4.	0 / 74 (0%)
5. Data Architect	5.	0 / 74 (0%)
6. AI specialist	6.	3 / 74 (4.05%)
7. AI Engineer	7.	8 / 74 (10.81%)
8. AI Researcher	8.	2 / 74 (2.7%)
9. Technical Recruiter	9.	0 / 74 (0%)
10. System architect	10.	1 / 74 (1.35%)
11. Other Show answers	11.	16 / 74 (21.62%)

Figure 1. Job position responses

According to the research data, dominant job positions on the market are Data Scientist and Engineer. Both of these positions hold around 50% (48,65% exactly). The data shows us that there are no market demands for security engineers or data architects. Amongst other potential job positions, we see that there is no specific job position that is dominant.
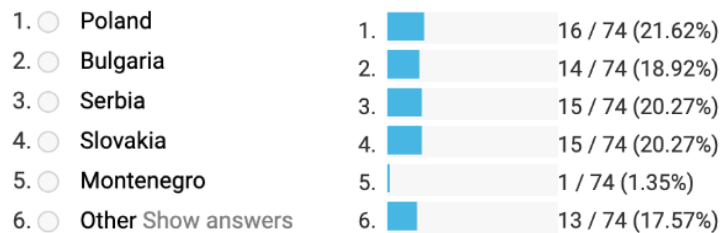
Discussion:

The survey shows that data processing is the most important role. Also, that the Data Architect role seems to not be necessary as other data relevant positions. This confirms that in today's real-world we have lots of data, and that we need to process it. The data also shows us that the technical recruiter job is not usually offered.

Main conclusions:

- There is a need to do a good data processing, and the data processing task seems to be the dominant one on the market
- No job offers for security engineers may imply that the companies are not paying enough attention to the security itself

3.2. Place of work

Data description:

Next question was related to the country of the job position offered. Results of this question are depicted in Figure 2.

1. ○	Poland	1.	16 / 74 (21.62%)
2. ○	Bulgaria	2.	14 / 74 (18.92%)
3. ○	Serbia	3.	15 / 74 (20.27%)
4. ○	Slovakia	4.	15 / 74 (20.27%)
5. ○	Montenegro	5.	1 / 74 (1.35%)
6. ○	Other Show answers	6.	13 / 74 (17.57%)

Figure 2. Countries where jobs are offered

Discussion:

The survey shows us that many of the countries included in the survey have a similar number of job position offerings. Poland has 16 (21,62%), Serbia and Slovakia 15 (20,27%), while Bulgaria has 14 (18,92%). On the other hand, Montenegro has 1 job position offered. Amongst other answers, the most dominant is Germany with 5 job offerings, while Switzerland has 3.

Main conclusions:

- At this moment, there are no many applied AI job offerings in Montenegro, which implies that this country is at its start of developing applied AI

3.3. Job kind

Data description:

Third question of this survey was concerning the job kind. One of the necessary options was to check if the job offer was full-time, or part time work. Also, if it is a permanent position, or internship type. On the other hand, it was also necessary to check if the job offering implied remote working, or working at home.

1. full time	1.	70 / 74 (94.59%)
2. part time work	2.	4 / 74 (5.41%)
3. permanent work	3.	2 / 74 (2.7%)
4. internship	4.	0 / 74 (0%)
5. remote work	5.	10 / 74 (13.51%)
6. work at home	6.	0 / 74 (0%)
7. Other Show answers	7.	10 / 74 (13.51%)
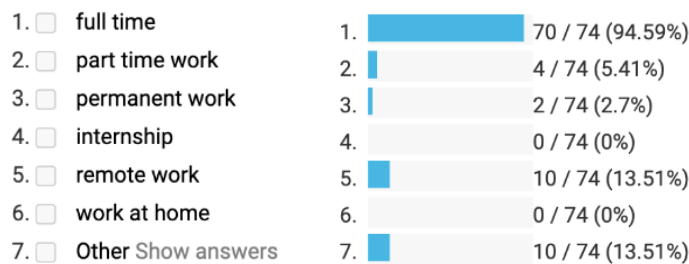
Figure 3. Survey answers on job kind

Discussion:

Based on the survey answers, we see that the most necessary job kind is a full time job, it's 70 answers out of 74, which is 94,59%. Regarding the workplace, we see that the most frequent kind is remote work, which is not surprising, considering that remote work has its expansion during and after COVID-19. Interesting fact to mention is that out of other responses to this question, all of them were stated as *hybrid.*

Main conclusions:

- Job positions for the applied AI are mostly full-time consuming jobs
- Remote work in this field is also one of its main characteristics, like in many other IT jobs

3.4. Size of the company

Data description:

Fourth question in this survey was targeting the size of the companies that offer jobs in applied AI. Companies were split into three categories: small, medium and big. Answer distribution is visible in Figure 4.
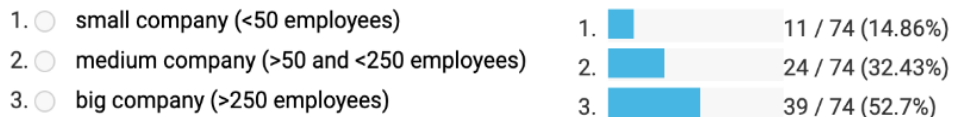

1. ○ small company (<50 employees)	1. ▮	11 / 74 (14.86%)
2. ○ medium company (>50 and <250 employees)	2. ▮	24 / 74 (32.43%)
3. ○ big company (>250 employees)	3. ▮	39 / 74 (52.7%)

Figure 4. Company sizes

Discussion:

The survey clearly shows that the most job offerings come from big companies. The company with more than 250 employees is considered as big. Out of 74 answers, 39 were classified as big companies (52,7%). Medium companies, which represent companies between 50 and 250 employees, take up 24 out of 74 answers, or 34,23%. We can see that clearly the smallest amount of job offerings come from small companies, 11. These numbers may imply that bigger companies are using more applied AI and are developing faster in this area.

Main conclusions:

- Company size is directly related to the need for applied AI experts. Bigger companies tend to have more job positions in applied AI.

3.5. Field of operation of the company

Data description:

Next question was related to the field in which the company operates. The purpose of the question is to see relations between applied AI and the field in which it can be applicable. That way we can see which fields may need more applied AI experts in future time.

Figure 5. Responses to the question about company field of operation

Discussion:

We can clearly see from the results obtained that no specific operation is more dominant than others. Though, two most frequent fields were Manufacture/Development and Consulting with 19 out of 74 responses. This can be expected, considering one of the most necessary fields is to develop and deliver products of various kinds. Customer Service and Finance are next with the score of 11. It is interesting to see that there is also 1 response related to the gaming industry, meaning that we may see expansion of applied AI also in this field.

Main conclusions:

- Applied AI can be applicable in many different fields
- Related to the first question from the survey, we see that there is no company with a main field of security. This may seem that lots of companies are still relying on human factor in this field

3.6. Educational requirements

Data description:

Next question from the survey was related to the necessary level of education in order to apply for the job position in applied AI. Answers were divided in several categories, by the level of the degree and also the specialization of the degree, whether it is a

degree in a computer-science related field or if it can be any field. The answers are depicted in the figure 6 below.
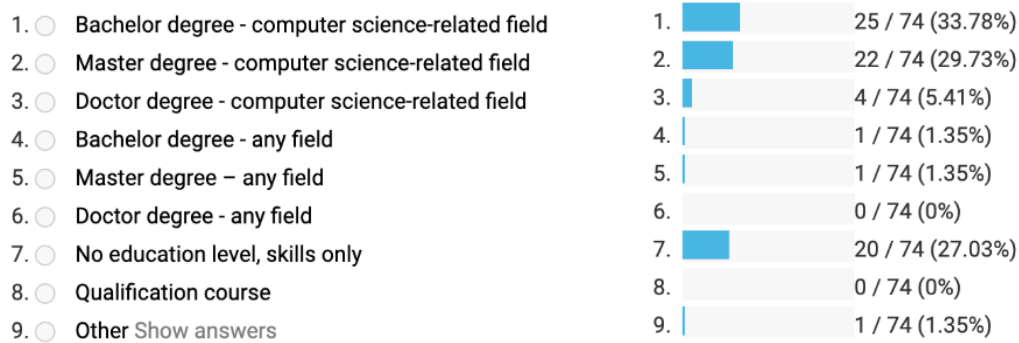
1. ◯ Bachelor degree - computer science-related field	1.		25 / 74 (33.78%)
2. ◯ Master degree - computer science-related field	2.		22 / 74 (29.73%)
3. ◯ Doctor degree - computer science-related field	3.		4 / 74 (5.41%)
4. ◯ Bachelor degree - any field	4.		1 / 74 (1.35%)
5. ◯ Master degree – any field	5.		1 / 74 (1.35%)
6. ◯ Doctor degree - any field	6.		0 / 74 (0%)
7. ◯ No education level, skills only	7.		20 / 74 (27.03%)
8. ◯ Qualification course	8.		0 / 74 (0%)
9. ◯ Other Show answers	9.		1 / 74 (1.35%)

Figure 6. Educational requirements

Discussion:

As expected, we see that the computer science related fields are the most relevant fields when applying for a job in applied AI. Bachelor Degree and Master Degree in these fields have 25 (33,78%) and 22(29,73%) responses, respectively. Interestingly, a big portion of answers also take jobs where no education level is necessary, and that skills are only requirements.

Main conclusions:

- Degree is important, but it is not crucial if you want to work into applied AI
- One of the focuses on trainings, courses should be developing skills in general

3.7. Required work experience

Data description:

Next question was concerning the necessary work experience that was required for the job position. The answers were on a scale from no requirements, 1 year of experience, 2 year experience, 3 years or more experience, and eventually, other required experience. Answers are shown in figure 7.

1. ○ no requirement	1.	24 / 74 (32.43%)
2. ○ 1 year experience	2.	5 / 74 (6.76%)
3. ○ 2 year experience	3.	21 / 74 (28.38%)
4. ○ 3 years or more experience	4.	21 / 74 (28.38%)
5. ○ Other Show answers	5.	3 / 74 (4.05%)

Figure 7. Required work experience

Discussion:

Actually, the biggest number of jobs have no requirement when it comes to the years of working experience. Out of 74 results, 24 of them are as such, or 32,43%. This may imply that lots of companies are investing into their employees, devoting time to teaching them and making them capable of finishing any task.

Next two answers that take up most are 2 years of experience and 3 years or more experience. Both of these have a total of 21 answers, or 28,38%. This states that besides big initiatives to invest into employees, most jobs require applicants to have at least some working experience. 1 year experience is a requirement for 5 answers, or 6,76%.

Amongst other answers, two of them ask for around 6 years of experience.

Main conclusions:
- There are applied AI jobs for practically all levels of work experience, making this field approachable by many individuals

3.8. Required competencies

Data description:

This question focuses on the required competencies in applied AI jobs. Different competencies included describing major areas of AI, as well as good information representation. Some of them included comparing, learning about and using machine learning algorithms. The whole list and answers of required competencies are depicted in figure below.

1. ☐ Describe major areas of AI as well as contexts in which AI methods may be applied.	1.	28 / 74 (37.84%)
2. ☐ Represent information in a logic formalism and apply relevant reasoning methods.	2.	31 / 74 (41.89%)
3. ☐ Represent information in a probabilistic formalism and apply relevant reasoning methods.	3.	21 / 74 (28.38%)
4. ☐ Be aware of the wide range of ethical considerations around AI systems, as well as mechanisms to mitigate problems.	4.	16 / 74 (21.62%)
5. ☐ Recognize the breadth and utility of machine learning methods.	5.	29 / 74 (39.19%)
6. ☐ Compare and contrast machine learning methods.	6.	36 / 74 (48.65%)
7. ☐ Select appropriate (classes of) machine learning methods for specific problems.	7.	44 / 74 (59.46%)
8. ☐ Use appropriate training and testing methodologies when deploying machine learning algorithms.	8.	29 / 74 (39.19%)
9. ☐ Explain methods to mitigate the effects of overfitting and curse of dimensionality in the context of machine learning algorithms.	9.	14 / 74 (18.92%)
10. ☐ Identify an appropriate performance metric for evaluating machine learning algorithms/tools for a given problem.	10.	27 / 74 (36.49%)
11. ☐ Recognize problems related to algorithmic and data bias, as well as privacy and integrity of data.	11.	19 / 74 (25.68%)
12. ☐ Debate the possible effects -- both positive and negative -- of decisions arising from machine learning conclusions.	12.	11 / 74 (14.86%)
13. ☐ Other Show answers	13.	11 / 74 (14.86%)

Discussion:

As seen from the survey, the main competence required in 59.46% of the jobs, or 44 out of 74, is selecting appropriate machine learning methods for specific problems. As expected, considering the fact that it is necessary to find out best processing of the data given. As a second most important competence, the survey states comparing and contrasting machine learning methods with the score of 36. We can conclude that these two competencies are very much related, hence, it is not a surprise they take the lead in the survey answers. Next, the survey gives us representation of information in a logical formalism and applying relevant reasoning methods, with a score of 31, or 41,89%. All other options have the score from 11 to 28.

Amongst other competencies, we see occurings of mathematical foundation, or programming experience in R or Python, programming languages mostly used in this area.

Main conclusions:
- Most important competence is knowing and comparing machine learning methods and selecting the appropriate one
- Improving the performance is one of the main competence for applied AI problems
- Representing the information and understanding it is a crucial way to implement good machine learning algorithms

3.9. Required programming languages

Ninth question concerns required programming languages. Many currently used frameworks have libraries and support for a wide variety of machine learning algorithms. Although, initial assessment suggests that there are some programming languages that are used the most, like Python, Java, C#, C++, R.

Those were the options for answers in this question. Results are depicted in a histogram below.

Data description:

1. ☐ Python	1.	59 / 74 (79.73%)
2. ☐ Java	2.	9 / 74 (12.16%)
3. ☐ C#	3.	11 / 74 (14.86%)
4. ☐ C++	4.	19 / 74 (25.68%)
5. ☐ R	5.	21 / 74 (28.38%)
6. ☐ Other Show answers	6.	15 / 74 (20.27%)
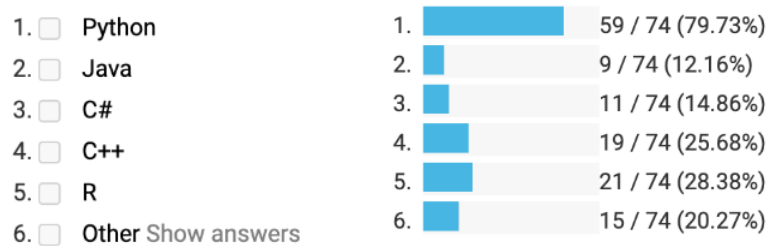
Figure 8. Knowledge of programming languages

Discussion:

As expected, the most dominant programming language required is Python. Python has many libraries already implemented and prepared for usage in Machine Learning problems. It can be integrated on various platforms. It is a fast and easy-to-start programming language which makes it suitable for resolving machine learning algorithms. 59 out of 74 answers were Python, or 79,73%.

The rest of programming languages are on a pretty similar scale. R programming languages was chosen 21 times. Then, C++ with 19 answers, C# with 11 and Java with 9.

Regarding other programming languages necessary, Visual Basic, Scala and Javascript were stated. One answer was related to DevOps.

Main conclusions:
- The trend for using the programming languages is the same as expected - Python is a necessary and a must in applied AI jobs

- Trainings should devote big percentage of time to learning Python programming language

3.10. Machine learning problem

Next question is related to the types of machine learning problems that need to be solved. They are divided into several categories. Classic Machine Learning problems, Deep Machine Learning problems, and Scientific Machine Learning problems.

Data description:

1. ☐ classic ML		1. ▬▬▬▬▬	57 / 74 (77.03%)
2. ☐ deep ML		2. ▬▬▬▬	47 / 74 (63.51%)
3. ☐ SciML		3. ▬▬	21 / 74 (28.38%)
4. ☐ Other Show answers		4. ▌	4 / 74 (5.41%)
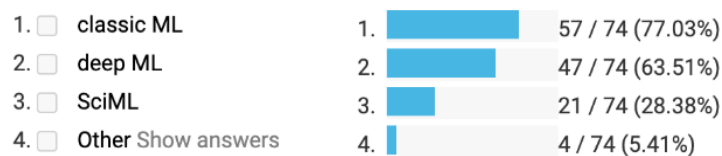
Figure 10. Types of machine learning problems

Discussion:

Based on the survey results, we see that the classic ML problems are still the most frequent type of problem that occurs. Results show that classic ML problems comprise 57 out of 74 answers, which is 77,03%. Also, deep learning ML problems are pretty frequent, with 47 answers. Scientific Machine Learning problems are chosen in 21 answers.

This implies that the classic ML and Deep Learning ML problems have most algorithms developed for the type of the problem.

Amongst other answers we see data engineering and distributed Machine Learning problems.

Main conclusions:
- Deep Learning and classical Machine Learning problems still represent the biggest percentage of problems in applied AI

3.11. Models being developed

Data description:

Developing an accurate and good model is an important task. Whichever the domain of the problem is, it is crucial to design a good ML model to obtain good results with the algorithm itself. With the development of applied AI, many different models are obtained. Models can be divided into those dependent on neural networks, and those

that are not. Besides several neural networks models, the possible answers were decision trees, rules, random forest, GRU, U-Net, or encoder-decoder networks.

Figure 11. Answers to models being developed

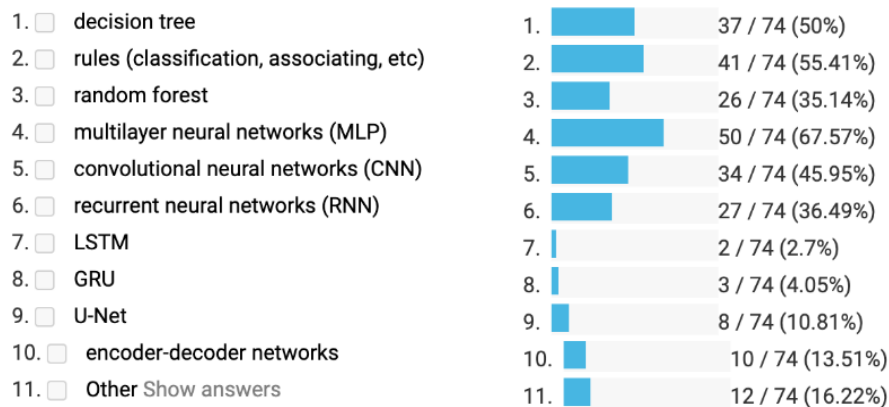|		
1. ☐ decision tree	1.	37 / 74 (50%)
2. ☐ rules (classification, associating, etc)	2.	41 / 74 (55.41%)
3. ☐ random forest	3.	26 / 74 (35.14%)
4. ☐ multilayer neural networks (MLP)	4.	50 / 74 (67.57%)
5. ☐ convolutional neural networks (CNN)	5.	34 / 74 (45.95%)
6. ☐ recurrent neural networks (RNN)	6.	27 / 74 (36.49%)
7. ☐ LSTM	7.	2 / 74 (2.7%)
8. ☐ GRU	8.	3 / 74 (4.05%)
9. ☐ U-Net	9.	8 / 74 (10.81%)
10. ☐ encoder-decoder networks	10.	10 / 74 (13.51%)
11. ☐ Other Show answers	11.	12 / 74 (16.22%)

Discussion:

Based on results from the survey, we see that neural networks are the most dominant model being developed for the applied AI positions. Multilayer Neural Networks (MLP) are selected 50 out of 74 times, or 67.57%. Next models being developed are models based on rules, for classification, association. They have a score of 41, or 55,41%.

Main conclusions:

- Neural network models are still most dominant ML model to develop, and courses and jobs should devote time to researching and training individuals about neural networks

3.12. Machine Learning tasks to be solved

Data description:

Next question was related to tasks that needed to be solved. Machine learning tasks are algorithms that enable computers to learn from data and make predictions or decisions based on that data. There are several types of machine learning tasks, each with its own approach and purpose. Some of the most common machine learning tasks include regression, classification and clusterization.

Besides those, in the survey options are given image captioning, natural language processing, speech recognition, image classification and segmentation. Results are shown in figure 12.

1.	regression	1.		43 / 74 (58.11%)
2.	classification	2.		51 / 74 (68.92%)
3.	clusterization	3.		26 / 74 (35.14%)
4.	image captioning	4.		17 / 74 (22.97%)
5.	natural language processing	5.		17 / 74 (22.97%)
6.	speech recognition	6.		9 / 74 (12.16%)
7.	image classification	7.		21 / 74 (28.38%)
8.	image segmentation	8.		17 / 74 (22.97%)
9.	Other Show answers	9.		13 / 74 (17.57%)
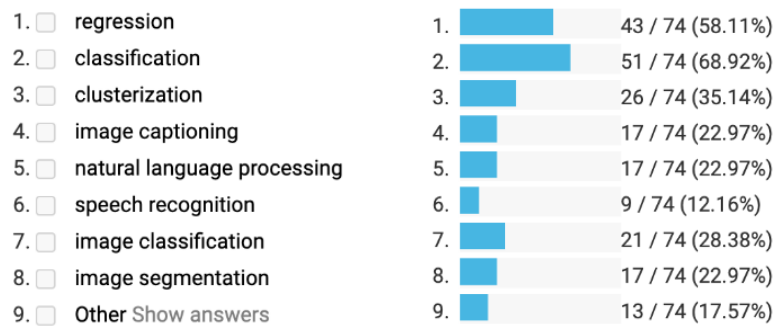
Figure 12. Machine Learning tasks to be solved

Discussion:

Based on the survey result, classification is the most frequent machine learning task to be solved, with 51 checked answers (68,92%). Regression is the next most frequent task with 43 checked answers (58,11%). 26 answers had clusterization checked (35,14%). 21 had checked image classification, while image captioning, natural language processing and image segmentation had 17 checks based on results. Speech recognition had 9. Other answers are mostly not stated, but the interesting one is 3D data processing.

We see that although there are various ML tasks we can tackle on, regression and classification are still the most frequent ones. With the recent improvements in text processing, we may expect a development in these tasks too.
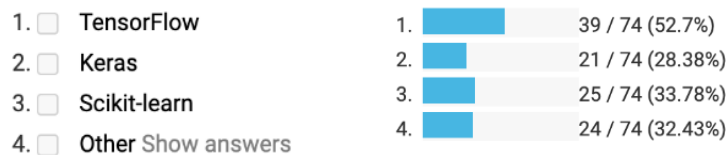
Main conclusions:

- Regression and classification are still the most frequent tasks to solve, and therefore should be addressed often

3.13. Knowledge of AI libraries

Data description:

Following question in the survey is related to the necessary knowledge of AI libraries like TensorFlow, Keras or Scikit-learn. Those are the most popular AI libraries used. TensorFlow is an end-to-end open-source machine learning platform. It provides a comprehensive suite of tools for building and deploying machine learning models. Keras is a high-level neural networks API that runs on top of TensorFlow. Scikit-learn is a machine learning library for Python that provides a range of algorithms for classification, regression, clustering, and dimensionality reduction.

Those were the options for answering this question. Results are in figure 13.

1. ☐ TensorFlow		1.		39 / 74 (52.7%)
2. ☐ Keras		2.		21 / 74 (28.38%)
3. ☐ Scikit-learn		3.		25 / 74 (33.78%)
4. ☐ Other Show answers		4.		24 / 74 (32.43%)

Figure 13. AI libraries used

Discussion:

Based on the results, TensorFlow is checked 39 times, or 52,7%. The survey shows knowledge of this library is the most important one. Scikit-learn and Keras have similar scores, 25 (33,78%), and 21 (28,38%), respectively.

Amongst other options, there are tools like MS Office, github, which essentially do not relate to ML. Pytorch also is mentioned 2 times in other responses.

Main conclusions:
- The survey highlights the crucial role of TensorFlow in the field of Machine Learning and Artificial Intelligence
- These results suggest that knowledge of these three libraries is essential for individuals interested in the applied AI field.

3.14. Used ecosystem

Data description:

Next question is related to the ML ecosystem used in the applied AI field.

There are several most popular ones like Apache Hadoop, or R studio. Anaconda is an open-source distribution of the Python and R programming languages for scientific computing, data science, and machine learning. Kaggle is a popular platform for data science competitions, offering a community of data scientists and machine learning engineers the ability to collaborate, learn, and compete on a variety of real-world problems. Google Colab (short for "Collaboratory") is a free online platform that enables users to write, run, and share Jupyter notebooks, which are interactive documents that combine code, text, and multimedia elements. R Studio is an integrated development environment (IDE) for the R programming language. MATLAB is a programming language and environment for numerical computation, visualization, and data analysis.

Results are depicted in figure 14.

1. ☐ Apache Hadoop	1.		22 / 74 (29.73%)
2. ☐ Anaconda	2.		13 / 74 (17.57%)
3. ☐ Kaggle	3.		7 / 74 (9.46%)
4. ☐ Colab	4.		7 / 74 (9.46%)
5. ☐ R Studio	5.		26 / 74 (35.14%)
6. ☐ Mathlab	6.		12 / 74 (16.22%)
7. ☐ Other Show answers	7.		35 / 74 (47.3%)
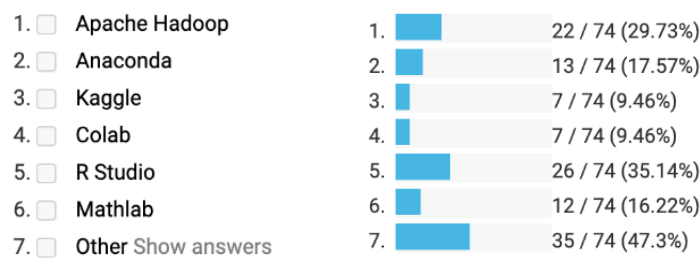
Figure 14. ML ecosystems used

Discussion:

The survey shows that R studio and Apache Hadoop are the most frequently used ecosystems in the applied AI field. R studio has 26 checked answers, or 35.14%. Next, Apache Hadoop has 22 checked answers, or 29,73%. Anaconda has 13, while MATLAB 12. Kaggle and Collab have only 7 checked answers, or 9,46%.

Amongst other options, there is no answer that is dominant over others. Many of the options are inserted like AWS, Docker, Gitlab, Postgres, Spark…

Main conclusions:
- R Studio and Apache Hadoop are the most frequently used ecosystems in the applied AI field according to the survey results.

- The survey indicates that there is no dominant answer among the other options, such as AWS, Docker, Gitlab, Postgres, and Spark, suggesting that these ecosystems are not as frequently used as the top choices.

3.15. Additional competencies needed

Data description:

This question concerns additional competencies needed for the job position. Many additional competencies were provided. The purpose of the question was to see in more detail The results are shown in the figure below.
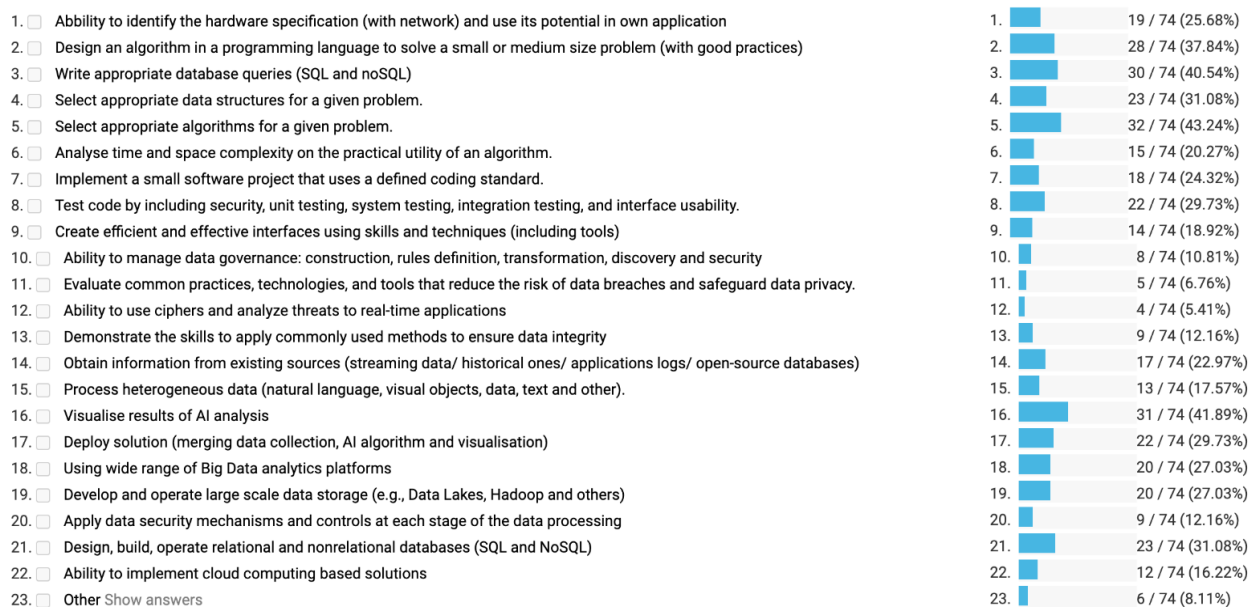
1.	Abbility to identify the hardware specification (with network) and use its potential in own application	19 / 74 (25.68%)
2.	Design an algorithm in a programming language to solve a small or medium size problem (with good practices)	28 / 74 (37.84%)
3.	Write appropriate database queries (SQL and noSQL)	30 / 74 (40.54%)
4.	Select appropriate data structures for a given problem.	23 / 74 (31.08%)
5.	Select appropriate algorithms for a given problem.	32 / 74 (43.24%)
6.	Analyse time and space complexity on the practical utility of an algorithm.	15 / 74 (20.27%)
7.	Implement a small software project that uses a defined coding standard.	18 / 74 (24.32%)
8.	Test code by including security, unit testing, system testing, integration testing, and interface usability.	22 / 74 (29.73%)
9.	Create efficient and effective interfaces using skills and techniques (including tools)	14 / 74 (18.92%)
10.	Ability to manage data governance: construction, rules definition, transformation, discovery and security	8 / 74 (10.81%)
11.	Evaluate common practices, technologies, and tools that reduce the risk of data breaches and safeguard data privacy.	5 / 74 (6.76%)
12.	Ability to use ciphers and analyze threats to real-time applications	4 / 74 (5.41%)
13.	Demonstrate the skills to apply commonly used methods to ensure data integrity	9 / 74 (12.16%)
14.	Obtain information from existing sources (streaming data/ historical ones/ applications logs/ open-source databases)	17 / 74 (22.97%)
15.	Process heterogeneous data (natural language, visual objects, data, text and other).	13 / 74 (17.57%)
16.	Visualise results of AI analysis	31 / 74 (41.89%)
17.	Deploy solution (merging data collection, AI algorithm and visualisation)	22 / 74 (29.73%)
18.	Using wide range of Big Data analytics platforms	20 / 74 (27.03%)
19.	Develop and operate large scale data storage (e.g., Data Lakes, Hadoop and others)	20 / 74 (27.03%)
20.	Apply data security mechanisms and controls at each stage of the data processing	9 / 74 (12.16%)
21.	Design, build, operate relational and nonrelational databases (SQL and NoSQL)	23 / 74 (31.08%)
22.	Ability to implement cloud computing based solutions	12 / 74 (16.22%)
23.	Other Show answers	6 / 74 (8.11%)

Figure 15. Additional competencies needed

Discussion:

Out of many possible additional competencies required for the job positions in applied AI field, the survey shows that selecting the appropriate algorithms for a specific problem is most important. Selecting the appropriate algorithm improves accuracy and efficiency. 32 out of 74 answers (43,24%) had this option selected.

The next important competency that is on top together with selecting the appropriate algorithm, is visualizing the results. It is important to make complex data

understandable. Also, it is a useful approach for identifying errors and bias, and it could improve the AI model. 31 answers checked this option.

Together with these competencies come designing the appropriate algorithm for a specific problem, with 28 checked answers.

Main conclusions:

- The most important additional competencies for a job in applied AI field is selecting and designing the appropriate ML algorithm
- Good data interpretation is necessary for its understanding, and improvement of AI models

3.16. Required soft skills

Data description:

Personal habits, attitudes, attributes compose a person's set of soft skills. Overall, soft skills are important for success in the workplace because they enable individuals to effectively navigate complex and dynamic work environments, and build strong relationships with colleagues and clients.

Next question focuses on required soft skills for the job position in applied AI. There were several soft skills posted as options for this answer, like Critical Thinking, Communication.

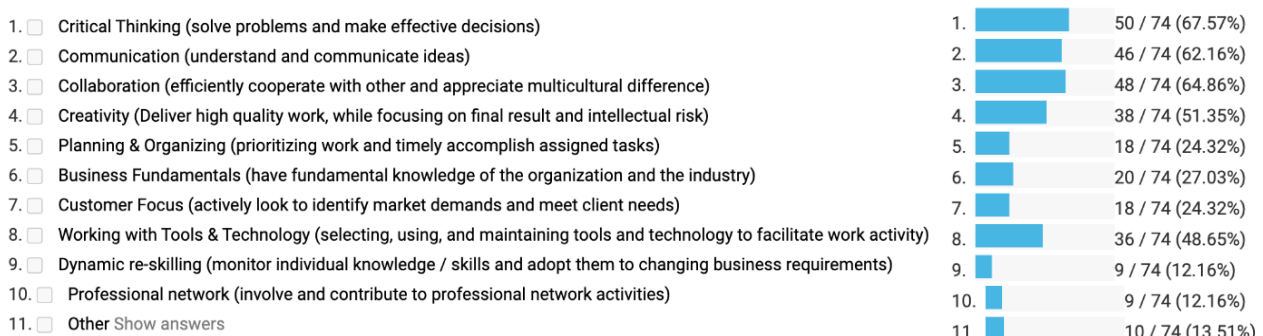Results and all options are depicted in figure 16.

	Option	Result
1.	Critical Thinking (solve problems and make effective decisions)	50 / 74 (67.57%)
2.	Communication (understand and communicate ideas)	46 / 74 (62.16%)
3.	Collaboration (efficiently cooperate with other and appreciate multicultural difference)	48 / 74 (64.86%)
4.	Creativity (Deliver high quality work, while focusing on final result and intellectual risk)	38 / 74 (51.35%)
5.	Planning & Organizing (prioritizing work and timely accomplish assigned tasks)	18 / 74 (24.32%)
6.	Business Fundamentals (have fundamental knowledge of the organization and the industry)	20 / 74 (27.03%)
7.	Customer Focus (actively look to identify market demands and meet client needs)	18 / 74 (24.32%)
8.	Working with Tools & Technology (selecting, using, and maintaining tools and technology to facilitate work activity)	36 / 74 (48.65%)
9.	Dynamic re-skilling (monitor individual knowledge / skills and adopt them to changing business requirements)	9 / 74 (12.16%)
10.	Professional network (involve and contribute to professional network activities)	9 / 74 (12.16%)
11.	Other Show answers	10 / 74 (13.51%)

Figure 16. Required soft skills

Discussion:

Based on the results gathered on the survey, Critical thinking, collaboration and communication, are the most selected ones. All take more than 60% of selected

answers. Critical thinking with 50 out of 74 selected answers, or 67,57%. Collaboration is selected 48 times, or 64,86%. Communication is selected on 46 answers, or 62,16%.

Amongst other responses, the most selected answer is working with tools and technology, with 36 (48,65%).

From these results we see that   ability to think critically and the ability to work in a team are the most important soft skills desired. We see that, in almost any software engineering jobs, are team jobs, and that it is important to know how to work in a team.

Main conclusions:

- Teamwork is most important soft skill set in applied AI field too

3.17. Main responsibilities and obligations

This question is the first of the series that included direct input, and not predefined options. It is related to the main responsibilities and obligations in the work position that was offered. This was an optional field to fill.

Data description:

As already stated, all the answers were obtained with users typing in their answers. Out of 74 total, 57 of them filled this input.

Discussion:

Answers on this question vary. Summarized by the results, we can see that main responsibilities and obligations are:
1. Generate analysis cubes, validate and automate data tools, collaborate within a team, and advise stakeholders on technology decisions.
2. Design and create Natural Language Processing systems, test and improve existing solutions, and continuously expand knowledge.
3. Design and build large-scale Machine Learning models, analyze and experiment with new features, and work on model performance and visualization.
4. Accountable for the whole AI solution lifecycle, guide a stable team, and integrate IT products/services to create required benefits.
5. Work on the full lifecycle of data, generate business insights, and develop advanced models while working in an agile environment.
6. Develop and extend the company Power BI reporting environment/data warehouse, analyze business needs, and support users in their reporting needs.
7. Develop end-to-end ETL solutions in a modern cloud-based data warehouse/lakehouse, lead meetings with technical teams, and manage pipelines using infrastructure as a code.

8. Work with databases and data visualization, and automate management reports while communicating and collaborating with internal and external stakeholders to develop chatbot solutions.

Other responses included various types of analytics, data preparation, model creation, or solution creation.

Main conclusions:
- There is no single responsibility needed for every posted job
- Responsibilities and obligations, as in other fields, vary from company requirements or job requirements

3.18. Proposed salary

This question focuses on the proposed salary for the job position that is being offered. With this question we can see if there is a trend about how much is usual salary in applied AI. Also, the inputs were global, meaning there were not restrictions in which currency or amount you can insert the salary. The question was optional to insert.

Data description:

Out of 74, the survey has only 31 answers to this question, which is 41,89%. Also, out of those 31, 6 were inserted as Not stated, or empty answers. Meaning, 25 concrete salaries have been posted by the survey.

The distribution of values are given in Table 1.

1000-3200 EUR	20
3200-8800 BGN salary (Gross)	2
$75,000 - $156,000 per anum	2
£130K per annum + OPTIONS	1

Table 1. Proposed salaries

Discussion:

As we can see, most of the data is related to EUR currency. Those salaries are in the range from 1000-3200 EUR, per month.

There are two job positions with currencies in BGN - Bulgarian lev. 3200-8800 BGN by month is close to 1600-4500 EUR.

Two of the proposed salaries are specified in dollars. $75,000 - $156,000 per annum is around 5,750-12,000 EUR per month.

The remaining proposed salary is stated in British Pound - £130K per annum. It is approximately 12,000 EUR per month.

4. Conclusions

In conclusion, AI has become a game-changer in the labor market, revolutionizing the way businesses operate and transforming entire industries. It has made it possible to automate repetitive and mundane tasks, which frees up time for workers to focus on more complex and creative work that requires human skills.

The survey shows us that the impact of AI on the labor market is big, and it is expected to continue in the future. There are many possibilities, many job positions that applied AI offers, and we can expect these only to expand in the future. The need for having applied AI in companies is getting bigger and bigger.

The survey also shows us that special attention needs to be paid to soft skills. Soft skills are essential for success in any field, and this is particularly true in the field of applied AI. Communication skills are critical for explaining complex technical concepts to non-technical stakeholders, including executives, clients, and end-users. Collaboration skills are essential for working in interdisciplinary teams, including data scientists, developers, and business analysts, to achieve project goals. Problem-solving skills are important for identifying and addressing technical and non-technical issues that arise during AI projects.

Overall, the effects of AI on the labor market are complex and multifaceted. AI has also created new opportunities and increased productivity in certain industries. As AI technology continues to evolve, it is essential that we find ways to maximize its benefits while mitigating its negative effects on the labor market.

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