Research 6 - Questionnaire for employers

Specifying Graduate Competencies in AI and Data Science

FAAI:

The Future is In Applied Artificial Intelligence

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Questionnaire for employers

- This survey was conducted in the context of the FAAI project to assess the needs of employers in graduate competencies in Artificial Intelligence, Machine Learning, and Data Science in general.
- The survey aimed to research the needs and expectations of employers and companies for the purpose of training specialists in the field of Applied AI.
- A total of 38 companies filled in the survey representing a good starting point for examination and analysis of their needs related to applied AI.

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The survey

- The survey consists of 31 questions, including questions on general competencies needed, the type of machine learning problems solved, and the AI/ML libraries used in companies.
- The survey also includes questions on soft skills required, additional competencies needed, employer satisfaction with the level of preparation of Master's studies' graduates in the area of AI, and views towards raising the qualification of current employees of organizations by letting them study AI at a master’s level.

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Collection and analysis of data

- Invited companies, mainly SMEs, filled the survey and express their requirements regarding student and graduate competences in applied AI and DS.
- A total of 38 companies filled in the survey representing a god starting point for examination and analysis of their need related to applied AI.
- Survey sections:
  1. General information about companies
  2. AI Job Research
  3. Additional competences
  4. Current state of local market
  5. Project involvement and information

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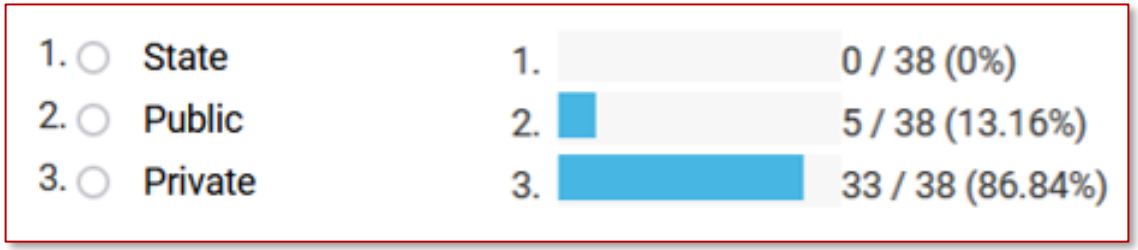
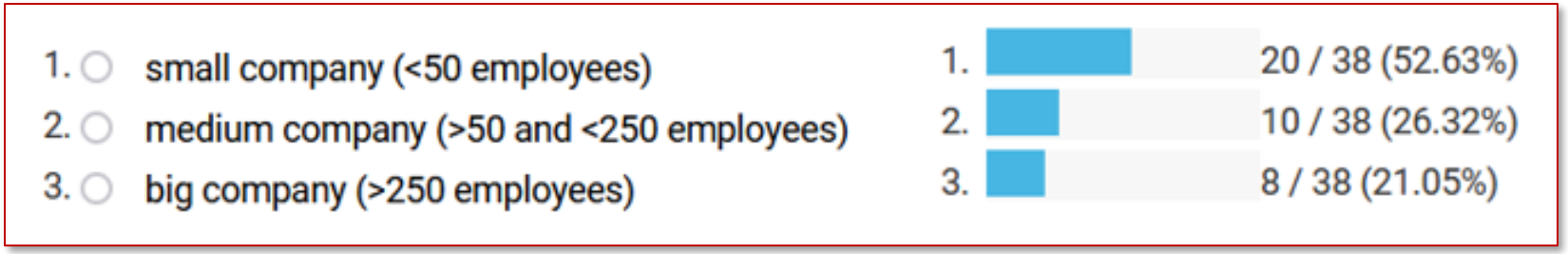
The type and size of organization





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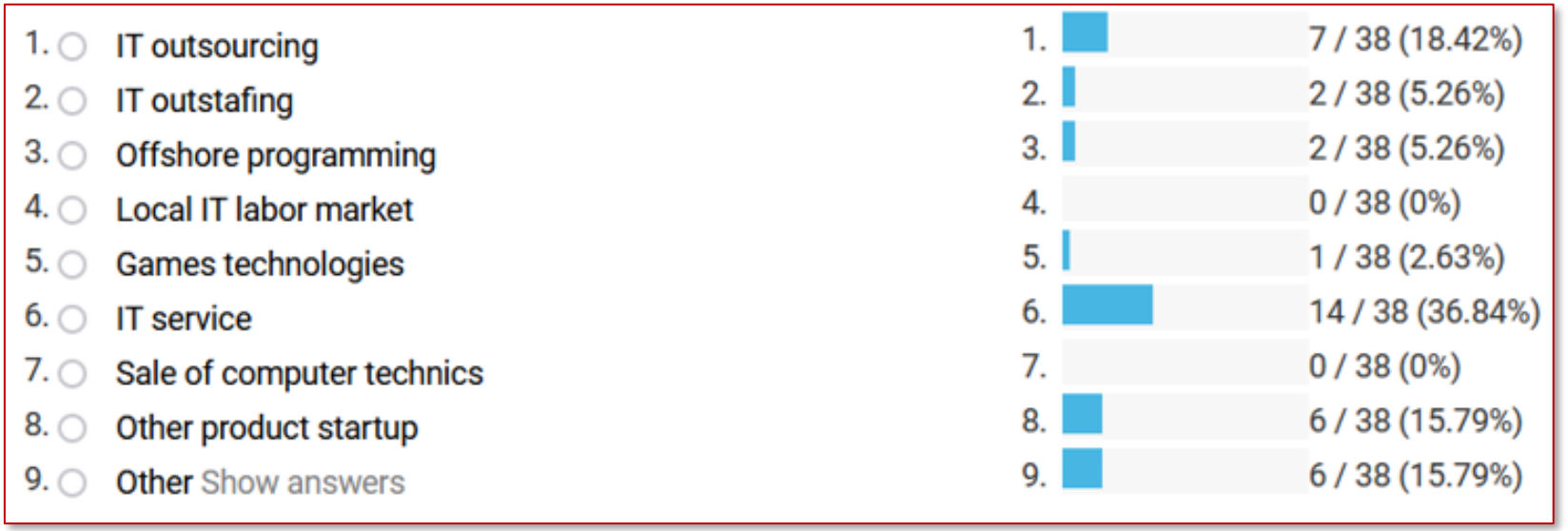
The segment of IT industry



1.	IT outsourcing	7 / 38 (18.42%)
2.	IT outstafing	2 / 38 (5.26%)
3.	Offshore programming	2 / 38 (5.26%)
4.	Local IT labor market	0 / 38 (0%)
5.	Games technologies	1 / 38 (2.63%)
6.	IT service	14 / 38 (36.84%)
7.	Sale of computer technics	0 / 38 (0%)
8.	Other product startup	6 / 38 (15.79%)
9.	Other Show answers	6 / 38 (15.79%)

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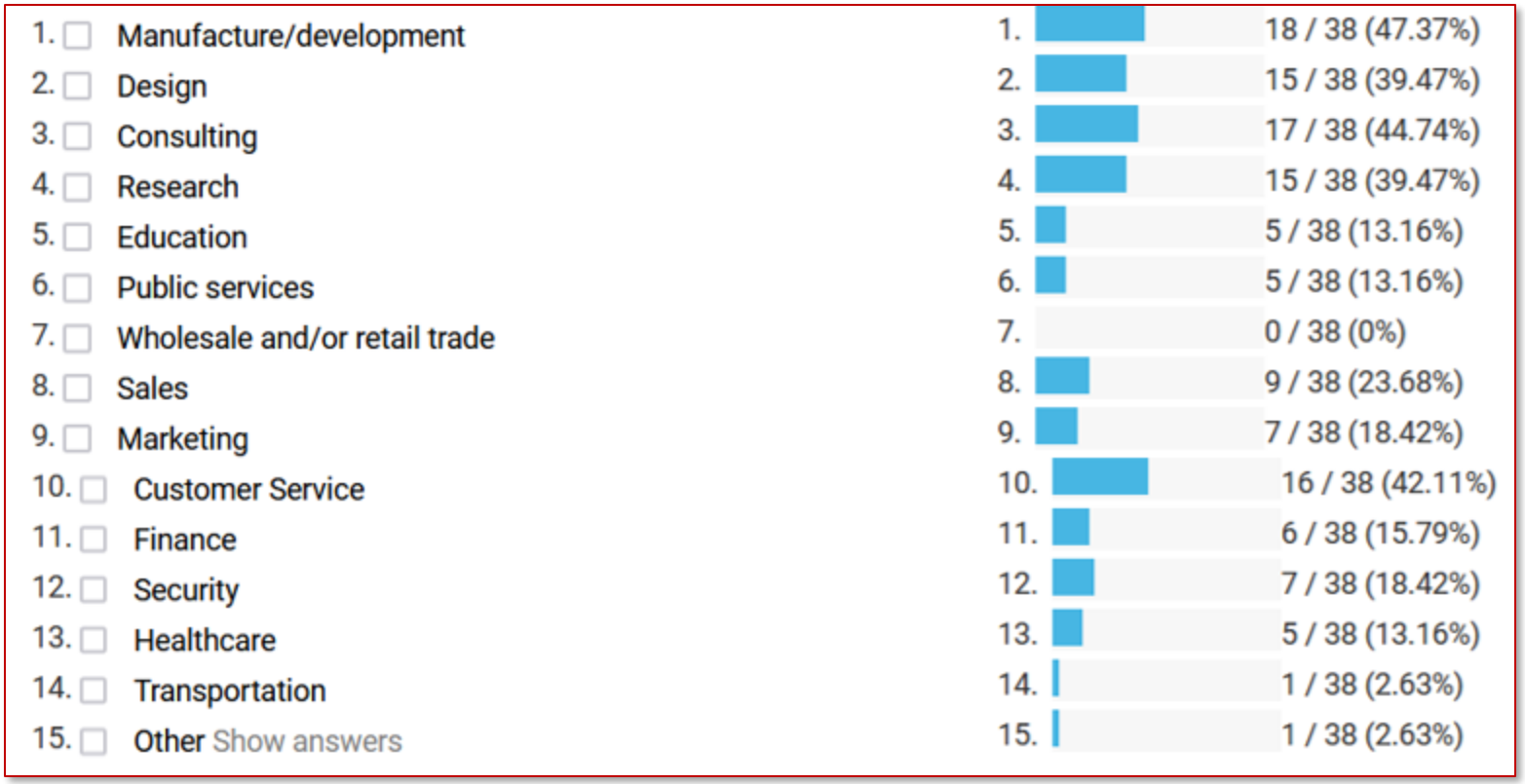
The main fields of activities



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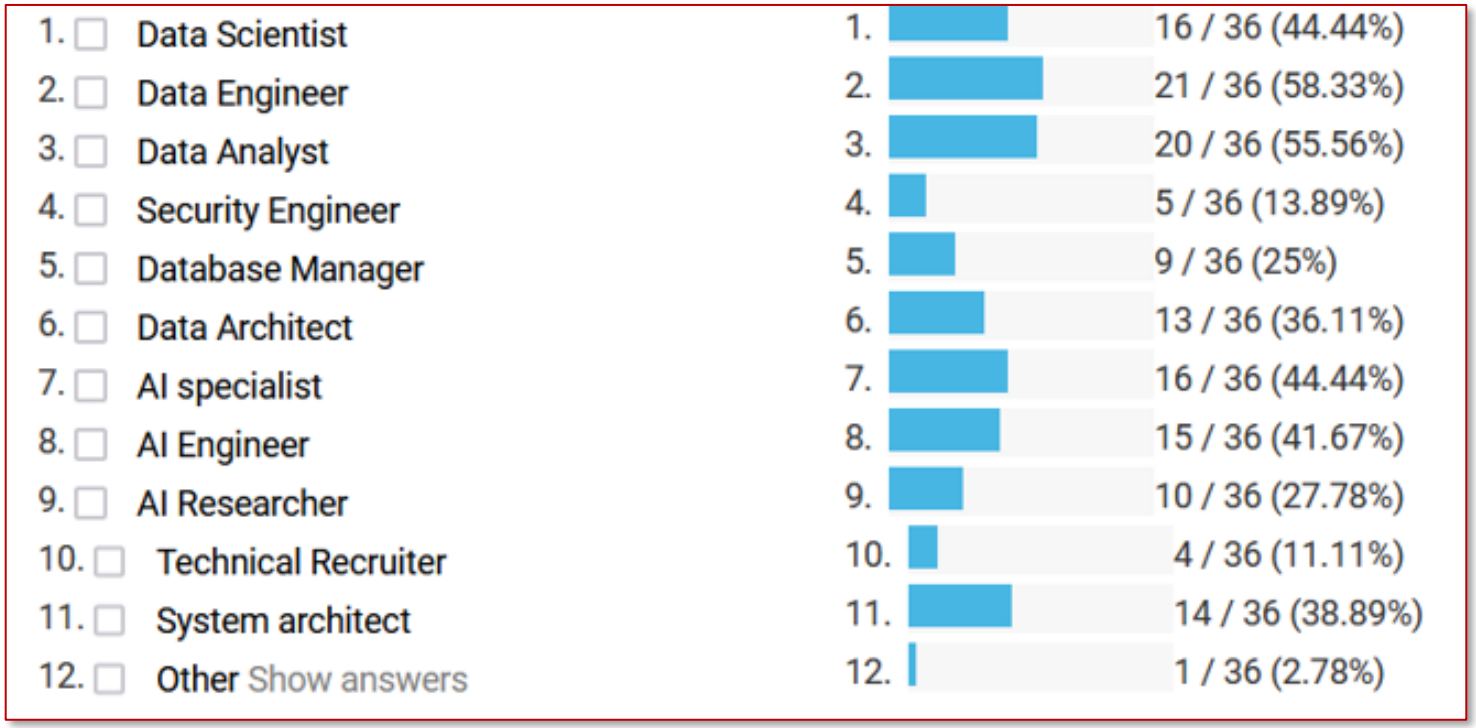
AI-related job positions



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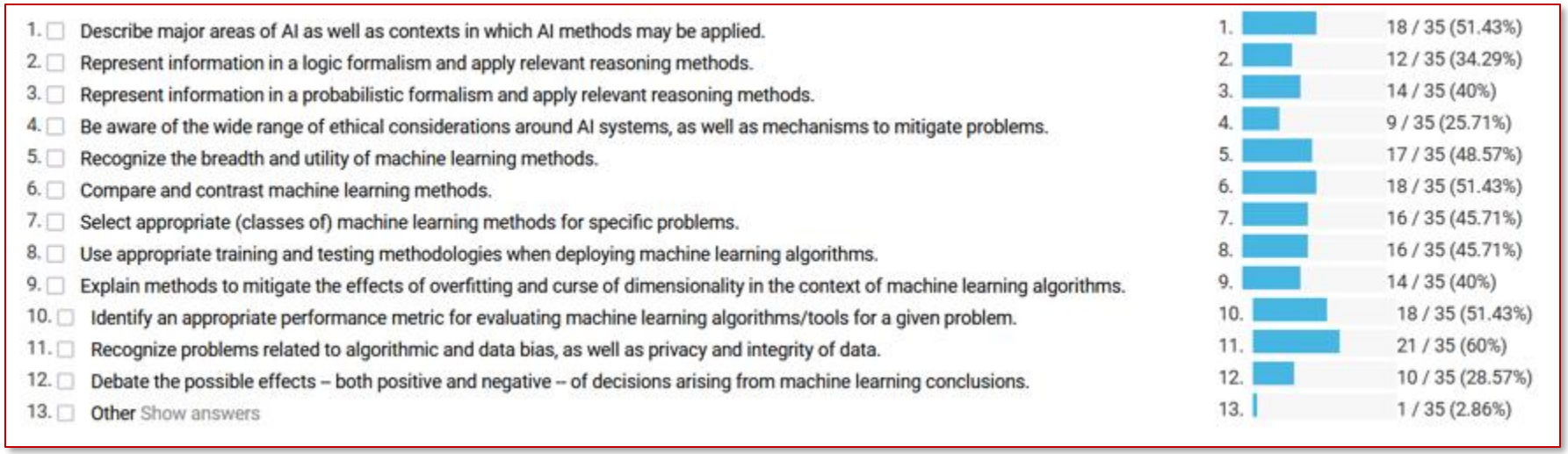
General competencies needed



1.	Describe major areas of AI as well as contexts in which AI methods may be applied.	18 / 35 (51.43%)
2.	Represent information in a logic formalism and apply relevant reasoning methods.	12 / 35 (34.29%)
3.	Represent information in a probabilistic formalism and apply relevant reasoning methods.	14 / 35 (40%)
4.	Be aware of the wide range of ethical considerations around AI systems, as well as mechanisms to mitigate problems.	9 / 35 (25.71%)
5.	Recognize the breadth and utility of machine learning methods.	17 / 35 (48.57%)
6.	Compare and contrast machine learning methods.	18 / 35 (51.43%)
7.	Select appropriate (classes of) machine learning methods for specific problems.	16 / 35 (45.71%)
8.	Use appropriate training and testing methodologies when deploying machine learning algorithms.	16 / 35 (45.71%)
9.	Explain methods to mitigate the effects of overfitting and curse of dimensionality in the context of machine learning algorithms.	14 / 35 (40%)
10.	Identify an appropriate performance metric for evaluating machine learning algorithms/tools for a given problem.	18 / 35 (51.43%)
11.	Recognize problems related to algorithmic and data bias, as well as privacy and integrity of data.	21 / 35 (60%)
12.	Debate the possible effects – both positive and negative – of decisions arising from machine learning conclusions.	10 / 35 (28.57%)
13.	Other Show answers	1 / 35 (2.86%)

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What abilities are needed for AI jobs

- AI and data science employees need to know the long and rich history behind the field, as well as the benefits and limitations of both logic- and probability-based representations of knowledge.
- They should be committed to applying machine learning as part of a process toward a goal for a client and be thorough when comparing learned models.
- Algorithm selection and evaluation are crucial to the quality of learned models and should be made with important stakeholders in mind.
- It is essential to apply accurate and ethical evaluation approaches for models in which we can have high confidence.
- Attention to detail is crucial in unsupervised learning techniques for data exploration, understanding, summarization, and visualization.

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The type of ML problems and the models developed

1. ☐	classic ML	24 / 35 (68.57%)
2. ☐	deep ML	24 / 35 (68.57%)
3. ☐	SciML	3 / 35 (8.57%)
4. ☐	Other Show answers	2 / 35 (5.71%)

1. ☐	decision tree	22 / 34 (64.71%)
2. ☐	rules (classification, associating, etc)	20 / 34 (58.82%)
3. ☐	random forest	14 / 34 (41.18%)
4. ☐	multilayer neural networks (MLP)	20 / 34 (58.82%)
5. ☐	convolutional neural networks (CNN)	18 / 34 (52.94%)
6. ☐	recurrent neural networks (RNN)	12 / 34 (35.29%)
7. ☐	LSTM	8 / 34 (23.53%)
8. ☐	GRU	5 / 34 (14.71%)
9. ☐	U-Net	5 / 34 (14.71%)
10. ☐	encoder-decoder networks	9 / 34 (26.47%)
11. ☐	Other Show answers	4 / 34 (11.76%)

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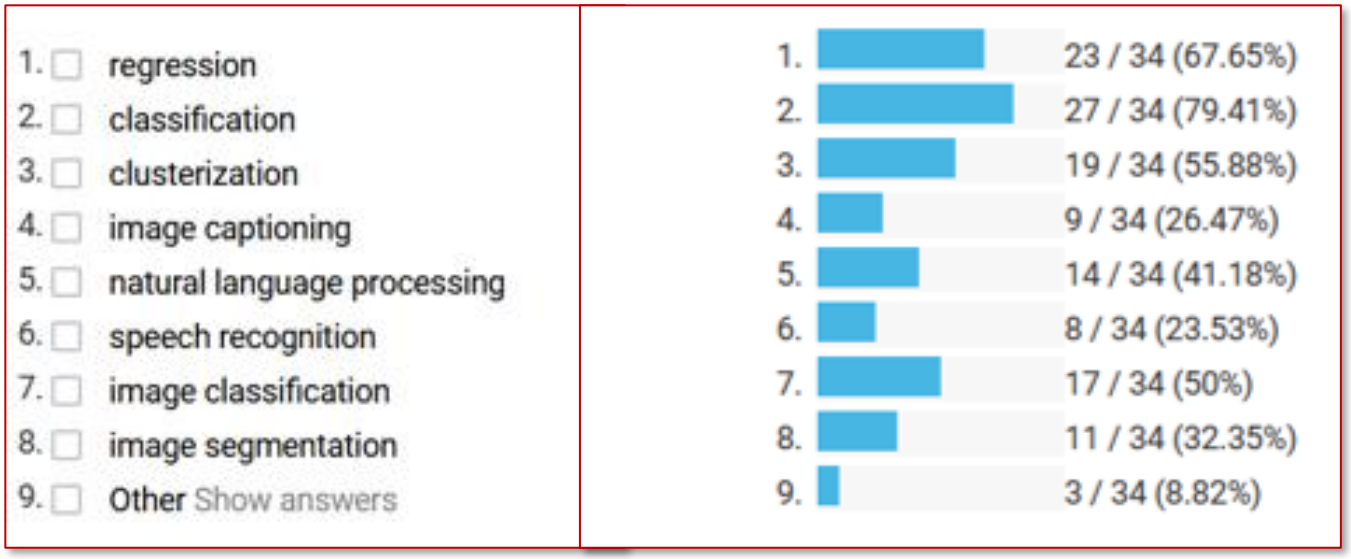
The type of ML tasks studied



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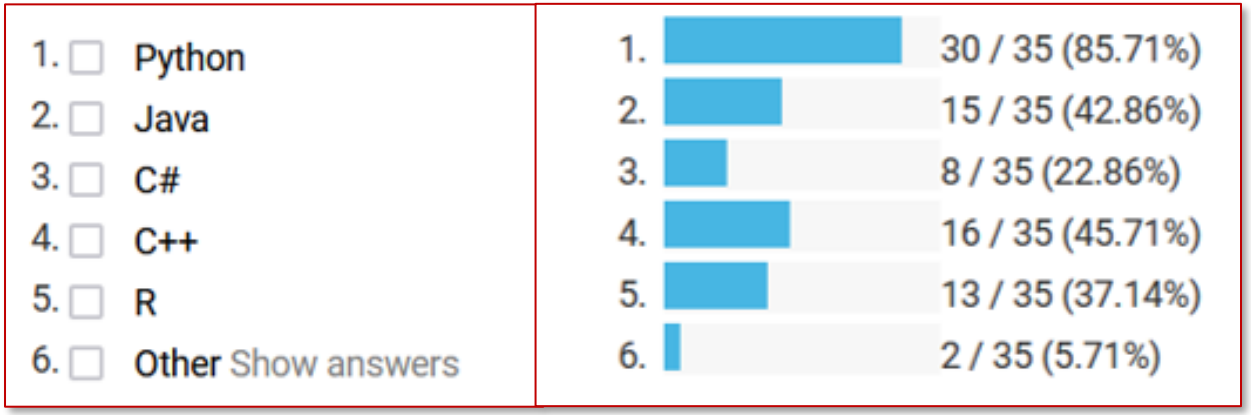
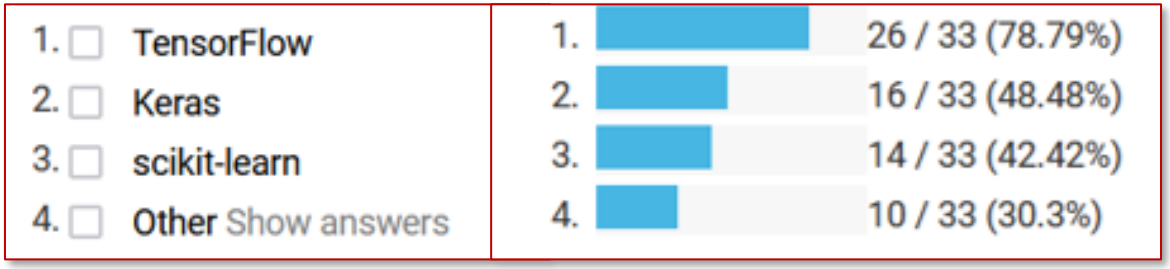
Programming languages and AI libraries (frameworks)





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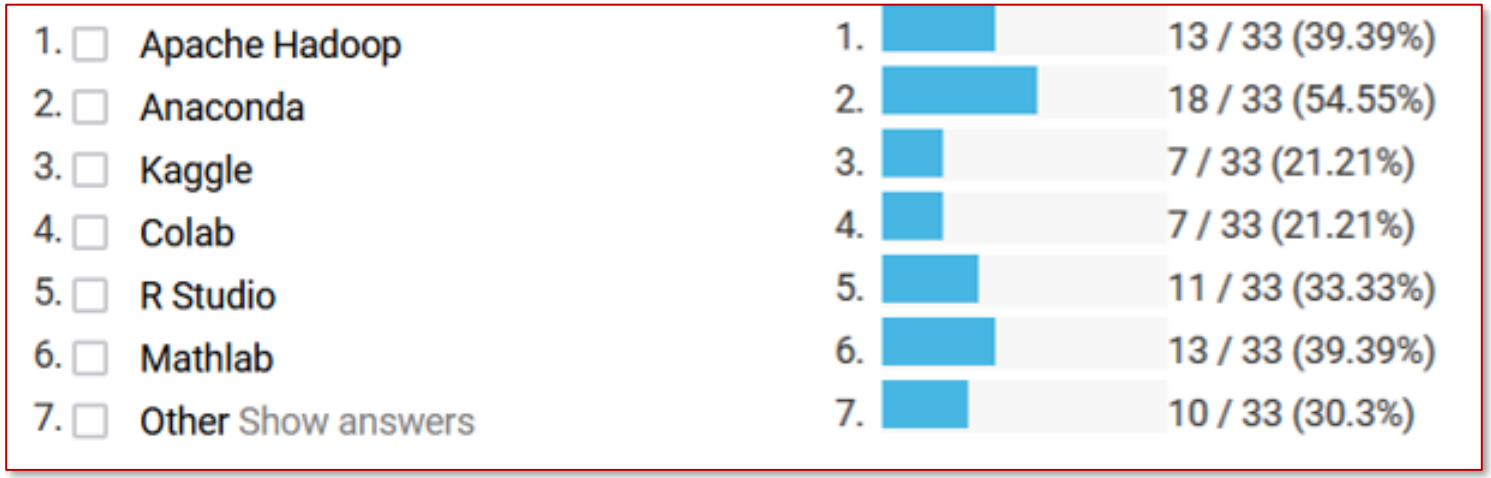
AI/ML ecosystem used



1.	Apache Hadoop	13 / 33 (39.39%)
2.	Anaconda	18 / 33 (54.55%)
3.	Kaggle	7 / 33 (21.21%)
4.	Colab	7 / 33 (21.21%)
5.	R Studio	11 / 33 (33.33%)
6.	Mathlab	13 / 33 (39.39%)
7.	Other Show answers	10 / 33 (30.3%)

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Employees' competences needed

- Companies prioritize competences related to innovation and adaptation, feasibility studies, and modern methods of psychology and pedagogy for academic/analytical employees.
- The ability to perform simulations and experiments and the ability to verify results with statistical tools were rated relatively lower by companies.
- Companies do not consider patenting inventions and technical innovations as the topmost priority for academic/analytical employees.

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Soft skills required

- Critical thinking, communication, and working with tools and technology are the most important soft skills required by companies
- Planning and organizing, business fundamentals, and collaboration are also highly valued by employers
- Customer focus, dynamic re-skilling, and professional networking are less frequently required
- It is important for job seekers to focus on developing and showcasing these important soft skills to improve their employability in the current job market.

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Additional competences needed

- The ability to select appropriate data structures and algorithms are the most important competences required by companies.
- Visualization of AI analysis and the ability to implement cloud computing-based solutions are also important competences.
- Analyzing threats to real-time applications, developing and operating large-scale data storage, and using a wide range of Big Data analytics platforms are considered less important competences.
- Companies value employees who have strong problem-solving and analytical skills.

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Additional job competencies required

- Technical skills in AI and data science are important but not sufficient for success in this field.
- Companies value employees and graduates who have a range of additional competences, such as the ability to work on problems of different scales, practical experience, software architecture, presentation skills, critical thinking, adaptability, and domain-specific knowledge in some cases.
- Effective communication skills are essential for success in this field, particularly for employees who interact with customers and participate in internal meetings.
- The competences required by companies in the AI and Data Science field are diverse, reflecting the interdisciplinary nature of this field.

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Employers' impressions related to AI graduates

- There is a severe shortage of AI specialists in the job market.
- Knowledge of AI-related fields and fields needed to work with AI are below standard for some companies.
- Theoretical knowledge of AI specialists is good, but practical skills are often lacking.
- Some companies feel that practical experience in simple AI projects is essential.
- Understanding business requirements and estimating practical aspects of development are crucial competences.
- Some companies do not feel the need for AI specialists.
- The market of AI specialists is improving, but some companies still find it challenging to source them.

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Employers' impressions related to IT graduates

- Employers have mixed opinions on the quality of IT graduates, but generally appreciate their technical proficiency and good background.
- Practical skills and creativity are crucial skills for IT specialists, and collaboration skills are essential for working in teams.
- The job market for junior IT specialists is sufficient, but finding regular/mid or senior-level specialists can be challenging.
- Opinions on the need for AI specialists are divided, with some employers indicating a severe gap in the job market, while others say there is no need for them.

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Employer satisfaction with MSc graduates in the area of AI

- The majority of companies were moderately satisfied with the level of preparation of Master's studies' graduates in the area of AI.
- A smaller percentage of companies were either not very satisfied or quite satisfied.
- Overall, the responses indicate that there is room for improvement in the level of preparation of Master's studies' graduates in the area of AI, as none of the companies rated their satisfaction as very high.

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Employer satisfaction with quantity of AI specialists available for hire

- More than one-third of the companies surveyed are not satisfied or only somewhat satisfied with the supply of AI specialists available for hire on the job market today.
- The majority of companies are satisfied with the supply of AI specialists available for hire on the job market today.
- There is still room for improvement in the quantity of AI specialists available for hire on the job market, as a significant proportion of companies are not satisfied with the current supply.

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Employer satisfaction of university graduates in the area of AI

- Graduates are perceived to have a high level of theoretical knowledge, but there is variability in their ability to apply this knowledge practically.
- They have a good level of knowledge in business management, economics, and law, as well as the latest international standards in the field.
- However, there is some concern regarding graduates' ability to find and keep a good job, with only 36.8% of respondents agreeing that graduates have a strong will and commitment in this area.
- The majority of respondents also agree that graduates have a good level of knowledge in English or other relevant foreign languages, which is crucial in a field that is heavily reliant on international collaboration.

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Employer participation in the project

- Most companies believe that building a website to present the results of AI research carried out by a local university is moderately important
- The majority of companies are interested in receiving a newsletter about the progress of the project
- The willingness to take an active part in the development of the project may depend on the specific nature and scope of the project, as well as the resources and priorities of each individual company
- Most companies are interested in being invited to a multiplier event where the results of the project will be presented

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Conclusions

- Many companies are willing to train and develop employees who are interested in learning about AI.
- Companies value competencies related to recognizing problems related to algorithmic and data bias, describing major areas of AI, and recognizing the utility of machine learning methods.
- Soft skills, such as critical thinking, communication, and working with tools and technology, are also essential.
- Some companies feel there is a lack of AI specialists on the job market, with good theoretical knowledge, but practical skills are often lacking.

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Conclusions (2)

- Most companies are satisfied with the supply of AI specialists available, but there is still room for improvement.
- Companies generally have a positive view towards raising the qualification of their current employees by letting them study AI at a master's level.
- There is a high perception of graduates having theoretical knowledge, and many companies believe it is important to build a website to present the results of AI research carried out by local universities and be informed about project outcomes.

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