# State-of-the-art-analysis on Research 1 and 2

Existing Training Courses in the field of Applied AI
Study of the labor market in the field of Applied AI

## FAAI:
### The Future is In Applied Artificial Intelligence

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University of Montenegro

# Existing training courses in the field of Applied AI
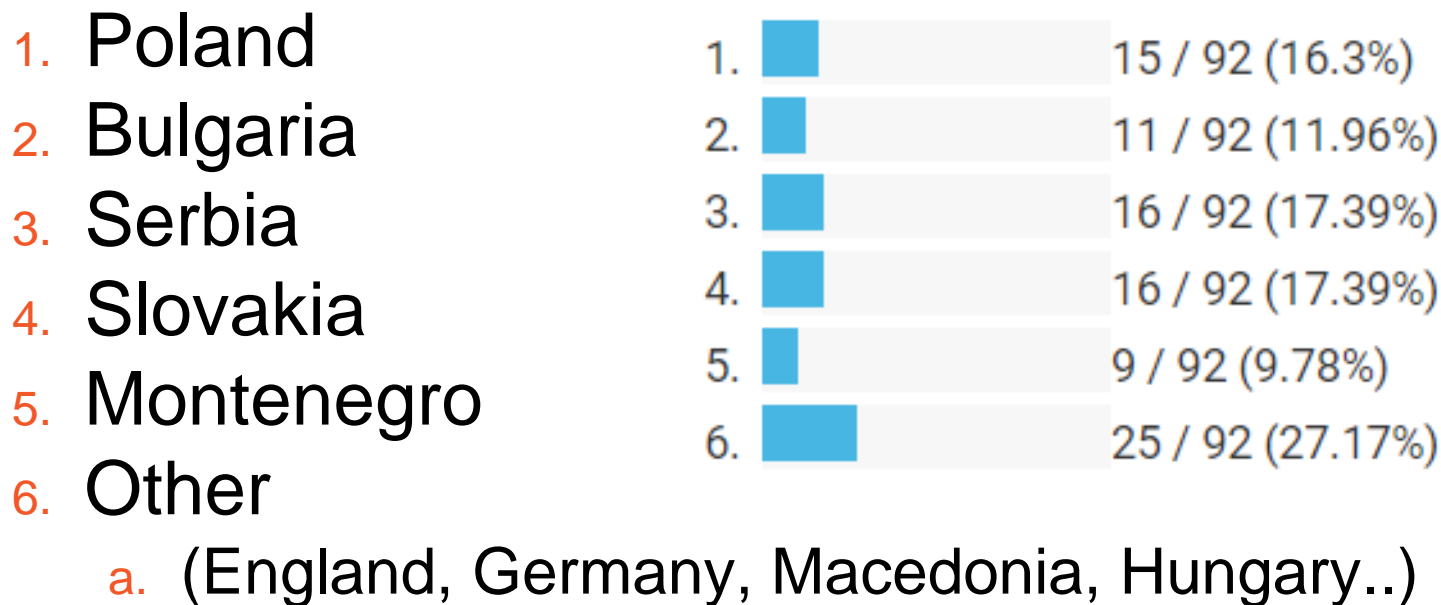
- 92 questionnaires
    - Poland market - 16
    - Bulgarian market - 29
    - Serbian market - 16
    - Slovak market - 16
    - Montenegrin market - 15

# Country in which the training takes place

1. Poland
2. Bulgaria
3. Serbia
4. Slovakia
5. Montenegro
6. Other
   a. (England, Germany, Macedonia, Hungary..)

| | | |
|---|---|---|
| 1. | | 15 / 92 (16.3%) |
| 2. | | 11 / 92 (11.96%) |
| 3. | | 16 / 92 (17.39%) |
| 4. | | 16 / 92 (17.39%) |
| 5. | | 9 / 92 (9.78%) |
| 6. | | 25 / 92 (27.17%) |

# Type of the course

1. Course at the academy
2. Bachelor degree program
3. Master degree program
4. Training course
5. Short course
6. Exchange program

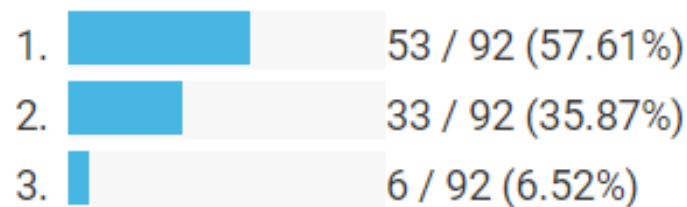| | | |
|---|---|---|
| 1. | ▮ | 9 / 92 (9.78%) |
| 2. | ▮ | 16 / 92 (17.39%) |
| 3. | ▮▮▮ | 46 / 92 (50%) |
| 4. | ▮ | 13 / 92 (14.13%) |
| 5. | ▮ | 8 / 92 (8.7%) |
| 6. | | 0 / 92 (0%) |
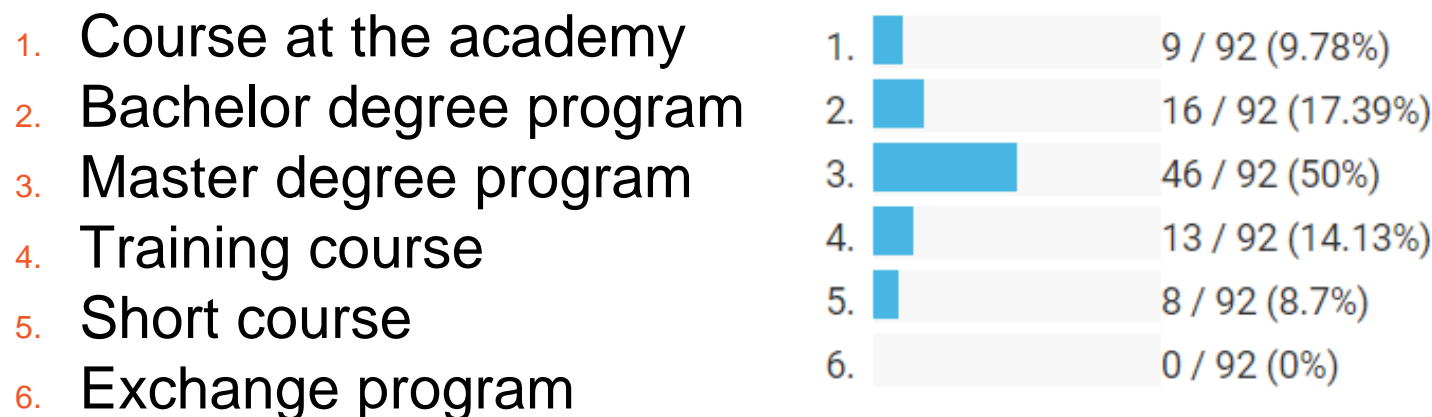
# Type of the course

- The majority of courses related to artificial intelligence are connected to university and academic community, indicating huge space for designing and implementing training courses that will be dominantelly oriented to the applied artificial intelligence.
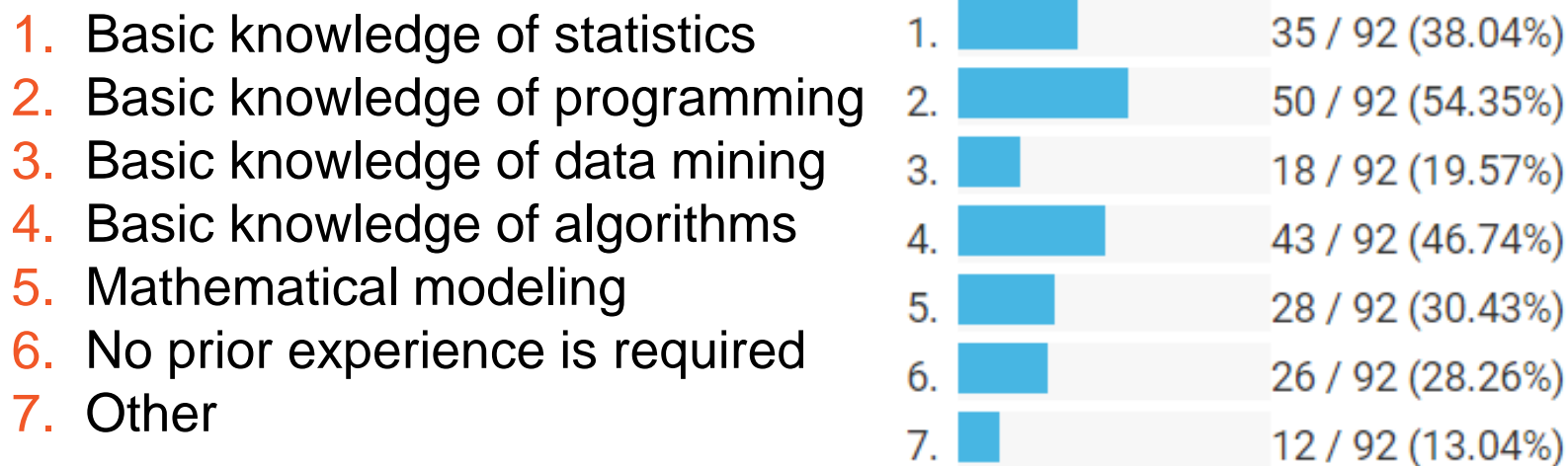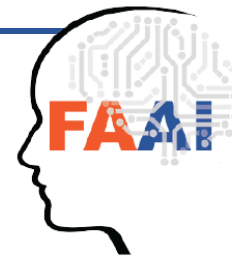
# Level of the course

1. Advanced
2. Beginner
3. Other

| | |
|---|---|
| 1. | 53 / 92 (57.61%) |
| 2. | 33 / 92 (35.87%) |
| 3. | 6 / 92 (6.52%) |

# Entry level for the course

1. Basic knowledge of statistics
2. Basic knowledge of programming
3. Basic knowledge of data mining
4. Basic knowledge of algorithms
5. Mathematical modeling
6. No prior experience is required
7. Other

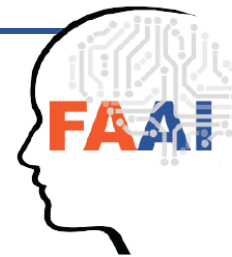| | |
|---|---|
| 1. | 35 / 92 (38.04%) |
| 2. | 50 / 92 (54.35%) |
| 3. | 18 / 92 (19.57%) |
| 4. | 43 / 92 (46.74%) |
| 5. | 28 / 92 (30.43%) |
| 6. | 26 / 92 (28.26%) |
| 7. | 12 / 92 (13.04%) |

# Entry level for the course

- It is obvious that one can expect to be required to have specific knowledge in order to attend training courses in the field of applied artificial intelligence.
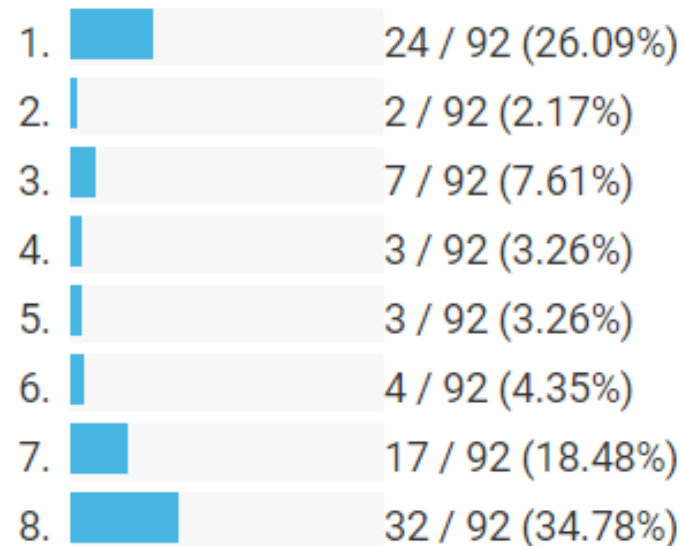
# Topics covered on the course

1. General
2. Knowledge
   and reasoning – logic based
3. Knowledge
   and reasoning – probability based
4. nPlanning and search strategies
5. Supervised learning
6. Unsupervised learning
7. Mixed methods
8. Deep learning

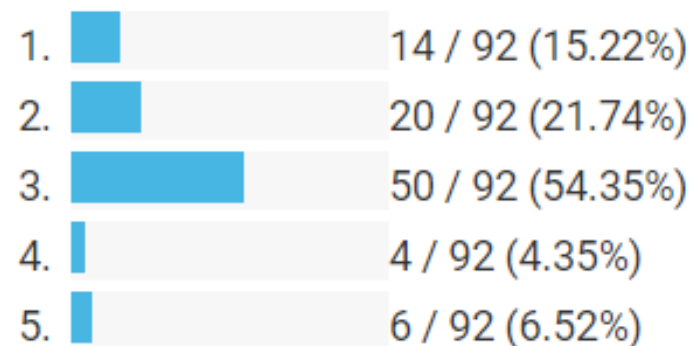| | |
|---|---|
| 1. | 24 / 92 (26.09%) |
| 2. | 2 / 92 (2.17%) |
| 3. | 7 / 92 (7.61%) |
| 4. | 3 / 92 (3.26%) |
| 5. | 3 / 92 (3.26%) |
| 6. | 4 / 92 (4.35%) |
| 7. | 17 / 92 (18.48%) |
| 8. | 32 / 92 (34.78%) |

# What competencies should be covered on the course?

- ## Most answers between 30% and 50%
  - Describe major areas of AI as well as contexts in which AI methods may be applied (67%)
  - Select appropriate (classes of) machine learning methods for specific problems
  - Use appropriate training and testing methodologies when deploying machine learning algorithms
  - Recognize the breadth and utility of machine learning methods
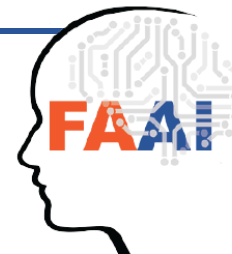  - Compare and contrast machine learning methods

# Expected results

1. Professional Certificate
2. Bachelor Degree
3. Master Degree
4. No certificate
5. Other

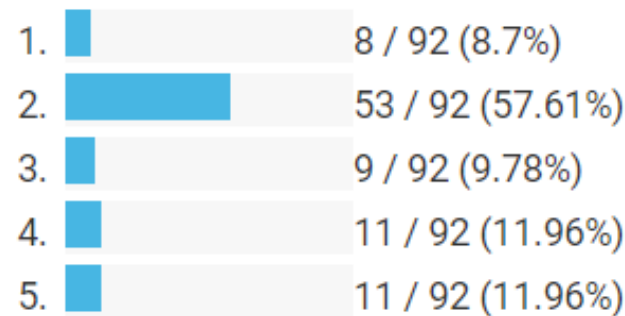| | |
|---|---|
| 1. | 14 / 92 (15.22%) |
| 2. | 20 / 92 (21.74%) |
| 3. | 50 / 92 (54.35%) |
| 4. | 4 / 92 (4.35%) |
| 5. | 6 / 92 (6.52%) |

# Form of knowledge assessment

- Combination of exams, coursework and practicals
- Written and/or oral exam
- Practical project

# Duration of the training

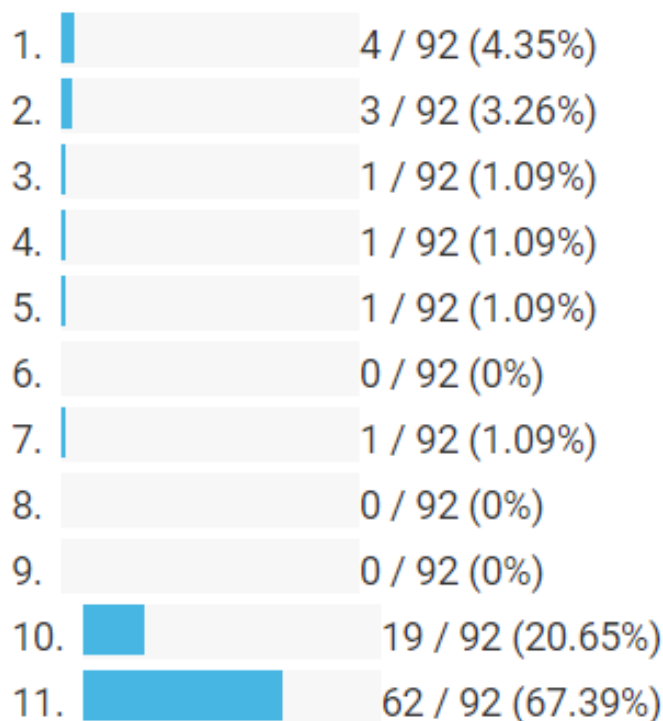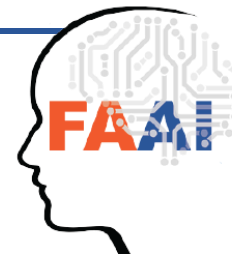1. Less than 1 month
2. 1-6 months
3. 6-12 months
4. 12-24 months
5. More than  24 months

| | |
|---|---|
| 1. | 8 / 92 (8.7%) |
| 2. | 53 / 92 (57.61%) |
| 3. | 9 / 92 (9.78%) |
| 4. | 11 / 92 (11.96%) |
| 5. | 11 / 92 (11.96%) |

# Price (in euro)

1. < 100
2. 100-250
3. 250-500
4. 500-750
5. 750-1000
6. 1000-1250
7. 1250-1500
8. 1500-1750
9. 1750-2000
10. > 2000
11. Not available

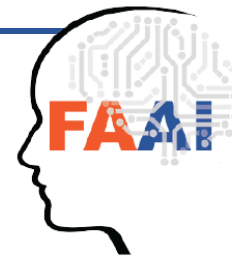| | |
|---|---|
| 1. | 4 / 92 (4.35%) |
| 2. | 3 / 92 (3.26%) |
| 3. | 1 / 92 (1.09%) |
| 4. | 1 / 92 (1.09%) |
| 5. | 1 / 92 (1.09%) |
| 6. | 0 / 92 (0%) |
| 7. | 1 / 92 (1.09%) |
| 8. | 0 / 92 (0%) |
| 9. | 0 / 92 (0%) |
| 10. | 19 / 92 (20.65%) |
| 11. | 62 / 92 (67.39%) |

# Existing training courses in the field of Applied AI

- There are numerous training courses available in the field of Applied AI
- Competency-based learning paradigms appear to be particularly effective in developing practical skills and preparing individuals for real-world applications of AI.
- Overall, it is essential to choose training courses that align with one's specific needs and goals, and also take into account the latest advancements in the field.
- It is important for training courses to keep up with the latest advancements in the field to remain relevant and effective.
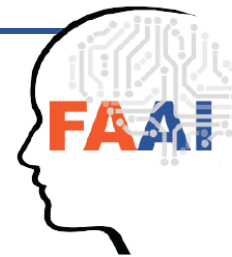
# Study of the labor market in the field of Applied AI

- ## 74 questionnaires
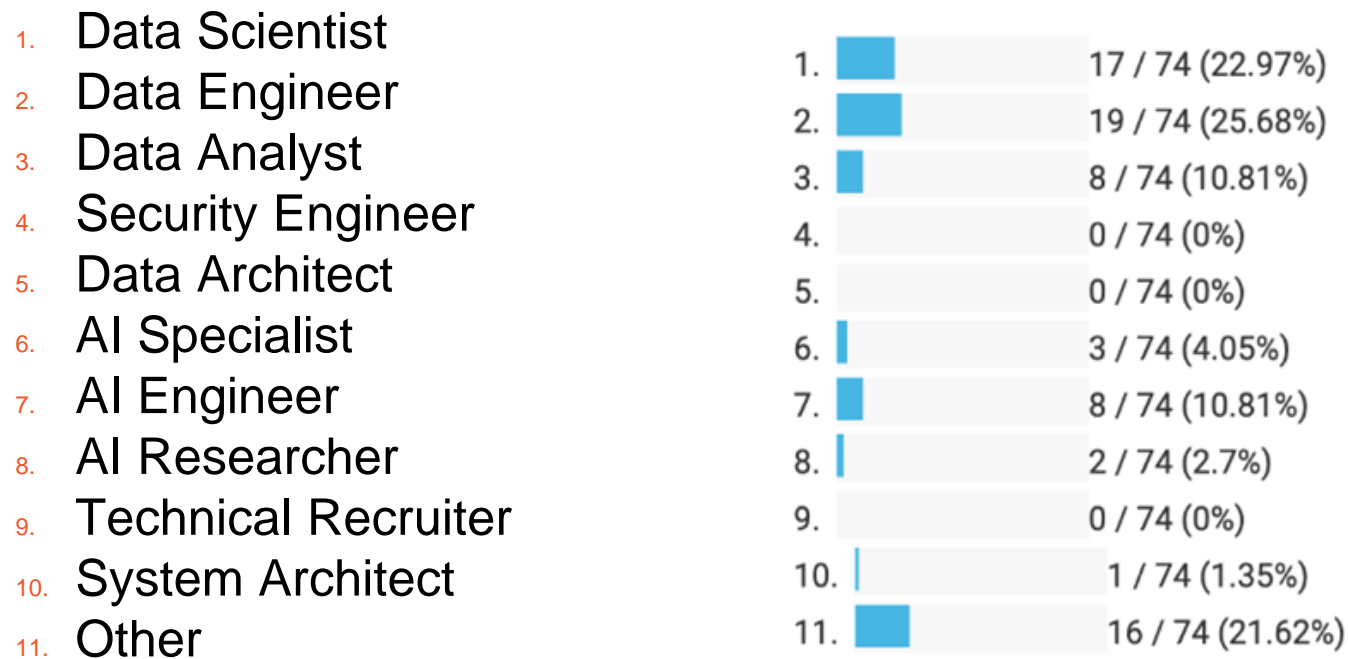  - UBB - University of Bielsko-Biala, Bielsko-Biala, Poland - 15 questionnaires
  - ULSIT - University of Library Studies and Information Technologies, Sofia, Bulgaria - 14 questionnaires
  - UNi - University of Nis, Serbia - 15 questionnaires
  - USCM - University of Ss. Cyril and Methodius in Trnava, Slovakia - 15 questionnaires
  - UoM - University of Montenegro, Montenegro - 15 questionnaires

# Position offered

1. Data Scientist
2. Data Engineer
3. Data Analyst
4. Security Engineer
5. Data Architect
6. AI Specialist
7. AI Engineer
8. AI Researcher
9. Technical Recruiter
10. System Architect
11. Other

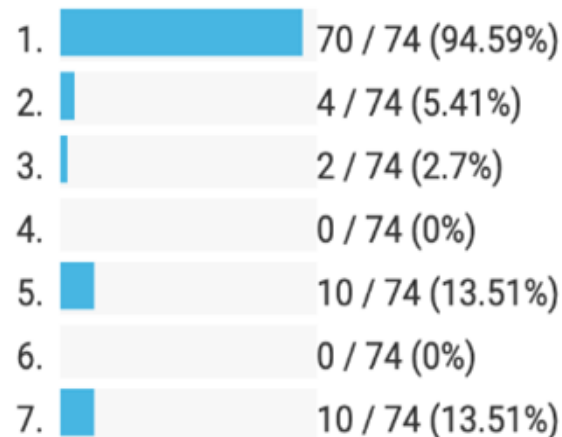| | |
|---|---|
| 1. | 17 / 74 (22.97%) |
| 2. | 19 / 74 (25.68%) |
| 3. | 8 / 74 (10.81%) |
| 4. | 0 / 74 (0%) |
| 5. | 0 / 74 (0%) |
| 6. | 3 / 74 (4.05%) |
| 7. | 8 / 74 (10.81%) |
| 8. | 2 / 74 (2.7%) |
| 9. | 0 / 74 (0%) |
| 10. | 1 / 74 (1.35%) |
| 11. | 16 / 74 (21.62%) |

# Job kind

1. Full-time work
2. Part-time work
3. Permanent work
4. Internship
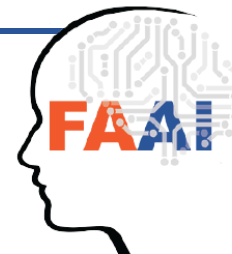5. Remote work
6. Work at home
7. Other
   a. hybrid

| | |
|---|---|
| 1. | 70 / 74 (94.59%) |
| 2. | 4 / 74 (5.41%) |
| 3. | 2 / 74 (2.7%) |
| 4. | 0 / 74 (0%) |
| 5. | 10 / 74 (13.51%) |
| 6. | 0 / 74 (0%) |
| 7. | 10 / 74 (13.51%) |

# Size of the company

1. Small company (< 50 employees)
2. Medium company (50 - 250 employees)
3. Big company (> 250 employees)

| | | |
|---|---|---|
| 1. | ▇ | 11 / 74 (14.86%) |
| 2. | ▇▇ | 24 / 74 (32.43%) |
| 3. | ▇▇▇ | 39 / 74 (52.7%) |

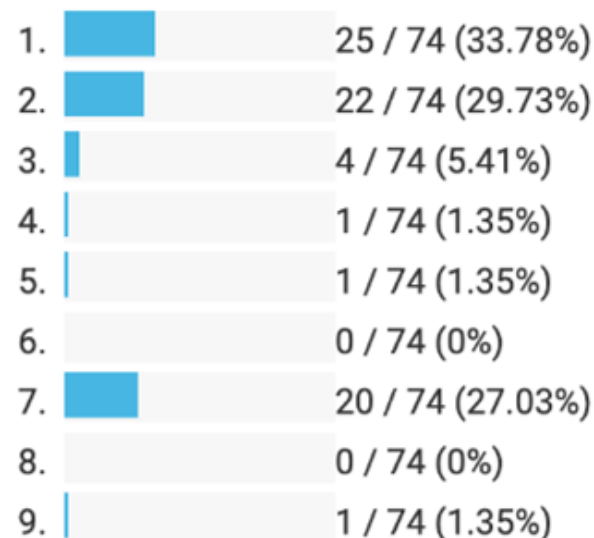# Field of operation of the company

- Manufacture/Development
- Consulting
- Research
- Customer Service
- Finance
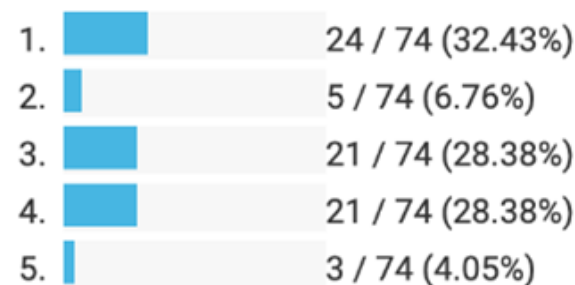- Healthcare

# Educational requirements

1. Bachelor degree - CS related field
2. Master degree - CS related field
3. Doctor degree - CS related field
4. Bachelor degree - any field
5. Master degree - any field
6. Doctor degree - any field
7. No education level, skills only
8. Qualification course
9. Other

| | |
|---|---|
| 1. | 25 / 74 (33.78%) |
| 2. | 22 / 74 (29.73%) |
| 3. | 4 / 74 (5.41%) |
| 4. | 1 / 74 (1.35%) |
| 5. | 1 / 74 (1.35%) |
| 6. | 0 / 74 (0%) |
| 7. | 20 / 74 (27.03%) |
| 8. | 0 / 74 (0%) |
| 9. | 1 / 74 (1.35%) |

# Required work experience

1. No requirement
2. 1 year of experience
3. 2 years of experience
4. 3 years or more
5. Other
   a. 6 years

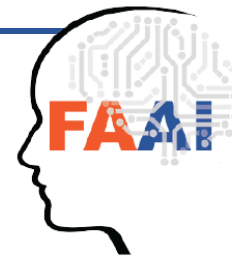| | |
|---|---|
| 1. | 24 / 74 (32.43%) |
| 2. | 5 / 74 (6.76%) |
| 3. | 21 / 74 (28.38%) |
| 4. | 21 / 74 (28.38%) |
| 5. | 3 / 74 (4.05%) |

# Required competencies

- Selecting appropriate machine learning methods for specific problems (60%)
- Contrasting machine learning methods (48%)
- Representation of information in a logical formalism and applying relevant reasoning methods (40%)

# Required programming languages

1. Python
2. Java
3. C#
4. C++
5. R
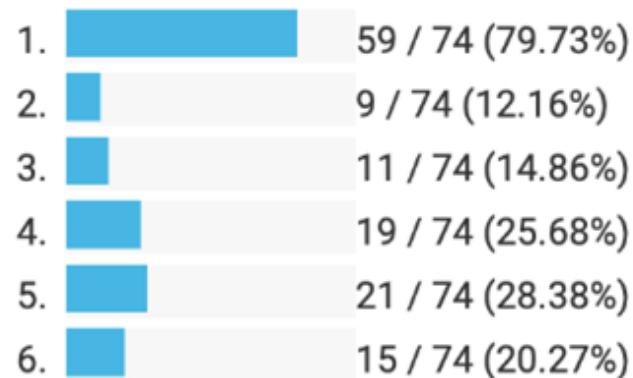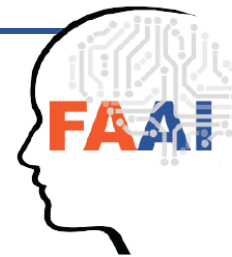6. Other
   a. VB.NET, Scala, Javascript

| | |
|---|---|
| 1. | 59 / 74 (79.73%) |
| 2. | 9 / 74 (12.16%) |
| 3. | 11 / 74 (14.86%) |
| 4. | 19 / 74 (25.68%) |
| 5. | 21 / 74 (28.38%) |
| 6. | 15 / 74 (20.27%) |

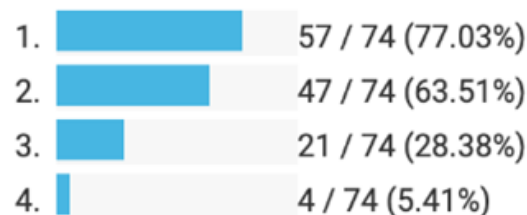Co-funded by
the European Union

# Machine learning problem to be solved

1. Classic ML problems

2. Deep ML problems

3. Scientific ML problems.

4. Other

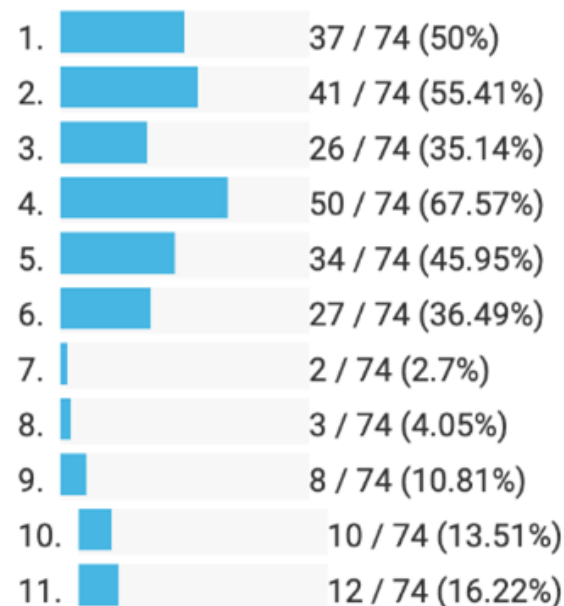   a. Data engineering, Distributed ML

| | |
|---|---|
| 1. | 57 / 74 (77.03%) |
| 2. | 47 / 74 (63.51%) |
| 3. | 21 / 74 (28.38%) |
| 4. | 4 / 74 (5.41%) |

# Models being developed

1. Decision tree
2. Rules (classification, associating, …)
3. Random forest
4. Multilayer neural networks
5. Convolutional neural networks
6. Recurrent neural networks
7. LSTM
8. GRU
9. U-NET
10. Encoder-decoder networks
11. Other
    a. not stated

| | |
|---|---|
| 1. | 37 / 74 (50%) |
| 2. | 41 / 74 (55.41%) |
| 3. | 26 / 74 (35.14%) |
| 4. | 50 / 74 (67.57%) |
| 5. | 34 / 74 (45.95%) |
| 6. | 27 / 74 (36.49%) |
| 7. | 2 / 74 (2.7%) |
| 8. | 3 / 74 (4.05%) |
| 9. | 8 / 74 (10.81%) |
| 10. | 10 / 74 (13.51%) |
| 11. | 12 / 74 (16.22%) |

# ML tasks to be solved

1. Regression
2. Classification
3. Clasterization
4. Image capturing
5. NLP
6. Speech recognition
7. Image classification
8. Image segmentation
9. Other
   a. usually not stated, 3D processing

| | |
|---|---|
| 1. | 43 / 74 (58.11%) |
| 2. | 51 / 74 (68.92%) |
| 3. | 26 / 74 (35.14%) |
| 4. | 17 / 74 (22.97%) |
| 5. | 17 / 74 (22.97%) |
| 6. | 9 / 74 (12.16%) |
| 7. | 21 / 74 (28.38%) |
| 8. | 17 / 74 (22.97%) |
| 9. | 13 / 74 (17.57%) |
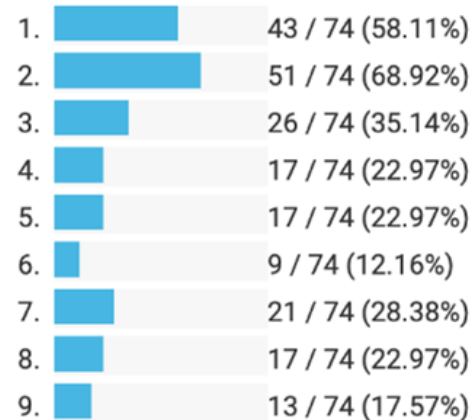
# Knowledge of AI libraries

1. Tensorflow
2. Keras
3. Sci-kit
4. Other
   a. not related to AI fields

| | |
|---|---|
| 1. | 39 / 74 (52.7%) |
| 2. | 21 / 74 (28.38%) |
| 3. | 25 / 74 (33.78%) |
| 4. | 24 / 74 (32.43%) |
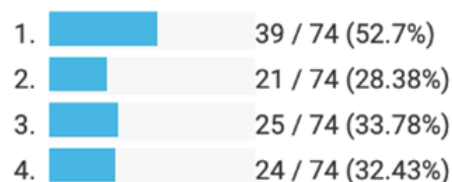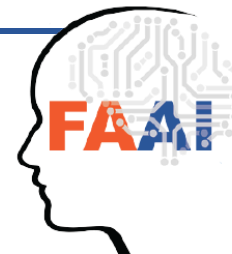
# ML ecosystem used

1. Apache Hadoop
2. Anaconda
3. Kaggle
4. Collab
5. R studio
6. Matlab
7. Other
   a. (AWS, Docker, Gitlab…)

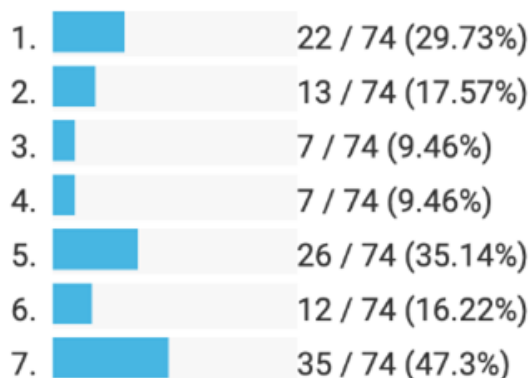| | |
|---|---|
| 1. | 22 / 74 (29.73%) |
| 2. | 13 / 74 (17.57%) |
| 3. | 7 / 74 (9.46%) |
| 4. | 7 / 74 (9.46%) |
| 5. | 26 / 74 (35.14%) |
| 6. | 12 / 74 (16.22%) |
| 7. | 35 / 74 (47.3%) |

# Required soft skills

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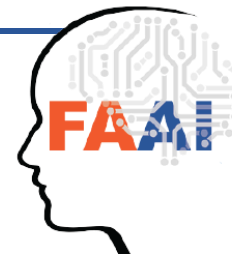7. ☐ Customer Focus (actively look to identify market demands and meet client needs)
8. ☐ Working with Tools & Technology (selecting, using, and maintaining tools and technology to facilitate work activity)
9. ☐ Dynamic re-skilling (monitor individual knowledge / skills and adopt them to changing business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

| # | Result |
|---|--------|
| 1. | 50 / 74 (67.57%) |
| 2. | 46 / 74 (62.16%) |
| 3. | 48 / 74 (64.86%) |
| 4. | 38 / 74 (51.35%) |
| 5. | 18 / 74 (24.32%) |
| 6. | 20 / 74 (27.03%) |
| 7. | 18 / 74 (24.32%) |
| 8. | 36 / 74 (48.65%) |
| 9. | 9 / 74 (12.16%) |
| 10. | 9 / 74 (12.16%) |
| 11. | 10 / 74 (13.51%) |

# Main responsibilities and obligations

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.
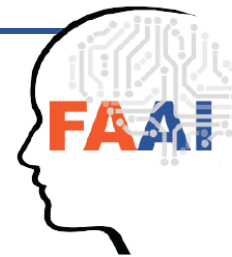
# Proposed salary

- ### 31/74 concrete answers to the question

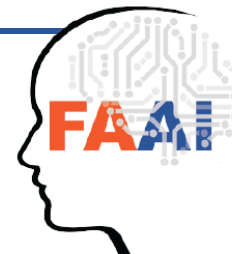| | |
|---|---|
| 1000-3200 EUR | 20 |
| 3200-8800 BGN salary (Gross) | 2 |
| $75,000 - $156,000 per annum | 2 |
| £130K per annum + OPTIONS | 1 |

# Study of the labor market in the field of Applied AI

- The impact of AI on the labor market is big
- Many job positions
- The survey also shows us that special attention needs to be paid to soft skills
- AI has created new opportunities

# Thank you!