Artificial Intelligence in the UK

The relevance of AI in the digital transformation of the UK labour market

Lightcast

Contents

Summary of Key Findings

With the UK Government pledging to make the nation a world leader in AI, and to ensure this growth benefits all sectors and regions, this report uses Lightcast's job postings data to examine demand for AI skills across the UK labour market in terms of how it compares internationally; which industries, regions, and occupations show the most demand for AI skills; and which specific AI skills are most in-demand. The key findings of this research are as follows:

1 Demand for AI, measured by the share of online job postings requesting AI skills, has more than tripled over the last decade in the UK, from approximately 0.3% in 2012 to around 1% in 2021, with demand continuing to grow in the first quarter of 2022.

2 The UK is among the leading nations in the world in terms of employer demand for AI skills, but is behind the US in first place, (with 1.3% of all its job postings mentioning AI skills), Sweden (1.3%), and Canada (1.1%).

3 Of the job postings requesting AI skills, those relating to Machine Learning have grown the most over the past few years, more than doubling their share of the overall labour market between 2016 and 2020.

4 The number of job postings mentioning AI skills increased across all industries from 2015 to 2021, with the highest share being in Information and Communication; Finance and Insurance; and Professional, Scientific, and Technical Activities.

5 Of the UK's 12 NUTS 1 areas (nine English regions, Scotland, Wales, and Northern Ireland,) Greater London leads the market for AI skills with 2.2% of all job postings in the capital mentioning them, followed by Northern Ireland (1.0%), and the South East (0.9%).

6 The list of local hotspots of AI demand across the nation is dominated by Cambridge, where 2.6% of all job postings mention AI skills, followed by Greater London (2.2%), Oxford (1.9%), Andover (1.6%), and Edinburgh (1.4%).

7 The occupation with the highest demand for AI skills over the past decade is Software Developer/Engineer, but a number of other occupations have also seen significant growth in demand, such as Data Scientist and Data Engineer.

8 Jobs where AI skills are requested in the employer's job description tend to pay more than the same jobs which don't mention these skills, with an average salary premium of around 20% across all jobs.

9 In terms of technical skills associated with AI roles, demand for Python has increased substantially, as has data science, and SQL, whilst in terms of human skills, communication, teamwork/collaboration, and research are among the most in-demand.

10 Technical AI skills are often highly transferable across a range of industries with, for example, Python, data science, and software engineering all being highly sought after in sectors as diverse as IT, Mining and Quarrying, Finance, and Manufacturing.

Introduction

Across the world, labour markets are facing transformative trends in the skills required of workers across the full spectrum of occupations and industries, with technological change and automation increasing labour market polarisation, while also reshaping the tasks performed in many occupations.

One of the main catalysts of these trends is the growth in artificial intelligence (AI). Previous analysis has found that demand for AI skills has grown sharply in numerous economies across the world, with the share of job postings calling for these skills having grown five-fold from 2013 to 2020 [1].

The United Kingdom government has aspirations to make the nation a world leader in AI, and in September 2021 it published a National AI Strategy, laying out "a ten-year plan to make Britain a global AI superpower" [2]. Hailing the UK as being "well placed to lead the world over the next decade as a genuine research and innovation powerhouse," the report set out three broad aims for AI development:

1. Invest and plan for the long-term needs of the AI ecosystem to continue our leadership as a science and AI superpower;

2. Support the transition to an AI-enabled economy, capturing the benefits of innovation in the UK, and ensuring AI benefits all sectors and regions;

3. Ensure the UK gets the national and international governance of AI technologies right to encourage innovation, investment, and protect the public and our fundamental values.

If these aims are to be realised, they will need to be underpinned by an evidence-based approach to understanding the following questions:

- How does demand for AI skills in the UK compare to other countries?

- Which industries, regions and occupations have the highest demand for AI skills?

- What are most important AI skills currently being requested by employers?

Drawing on our proprietary database of millions of current and historical job postings, the aim of this report is to shed light on these questions, particularly with the following stakeholders in mind:

- **Policymakers** who are seeking to understand how AI has impacted their regional workforces and economic development plan;

- **Employers** who are looking to understand how AI has affected their industry and what skills they should be hiring for to keep up-to-date with market trends;

- **Education providers** who are looking to identify which AI skills they should be including in their courses and modules;

- **Learners** who need to know the skills they should be seeking in training for jobs in AI-related fields.

Alongside this report, we've also partnered with the visual data storytellers, **Infogr8,** to create an interactive report which allows users to delve into more detail at the local level to understand how AI is affecting particular labour markets [3]. We hope that this report and the accompanying online report will prove to be a timely and helpful contribution in answering some of the most pressing questions on the demand for AI skills in the UK labour market.

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[1] Daniel Zhang, Saurabh Mishra, Erik Brynjolfsson, John Etchemendy, Deep Ganguli, Barbara Grosz, Terah Lyons, James Manyika, Juan Carlos Niebles, Michael Sellitto, Yoav Shoham, Jack Clark, and Raymond Perrault (2021): The AI Index 2021 Annual Report.

[2] https://www.gov.uk/government/publications/national-ai-strategy/national-ai-strategy-html-version

[3] https://aiskills.lightcast.io/

Overview of AI Diffusion in the UK

We begin by looking at an international comparison of AI adoption, as measured by the share of employer job postings in each country which mention AI skills (see the Appendix for the list of skills we have identified as relating to AI).

In Figure 1, we have included data from six G7 countries, as well as Sweden and New Zealand, and as you can see employer demand for AI has increased significantly across each of these labour markets over the past decade, with all nine countries seeing their share of postings mentioning AI more than doubling since 2014 (note: the data for 2022 is for the first quarter, and we have this for five of the nine countries).

Figure 1: **AI Share of Total Postings, by Country, 2014-2021 (and to Q1 of 2022 for five countries)**
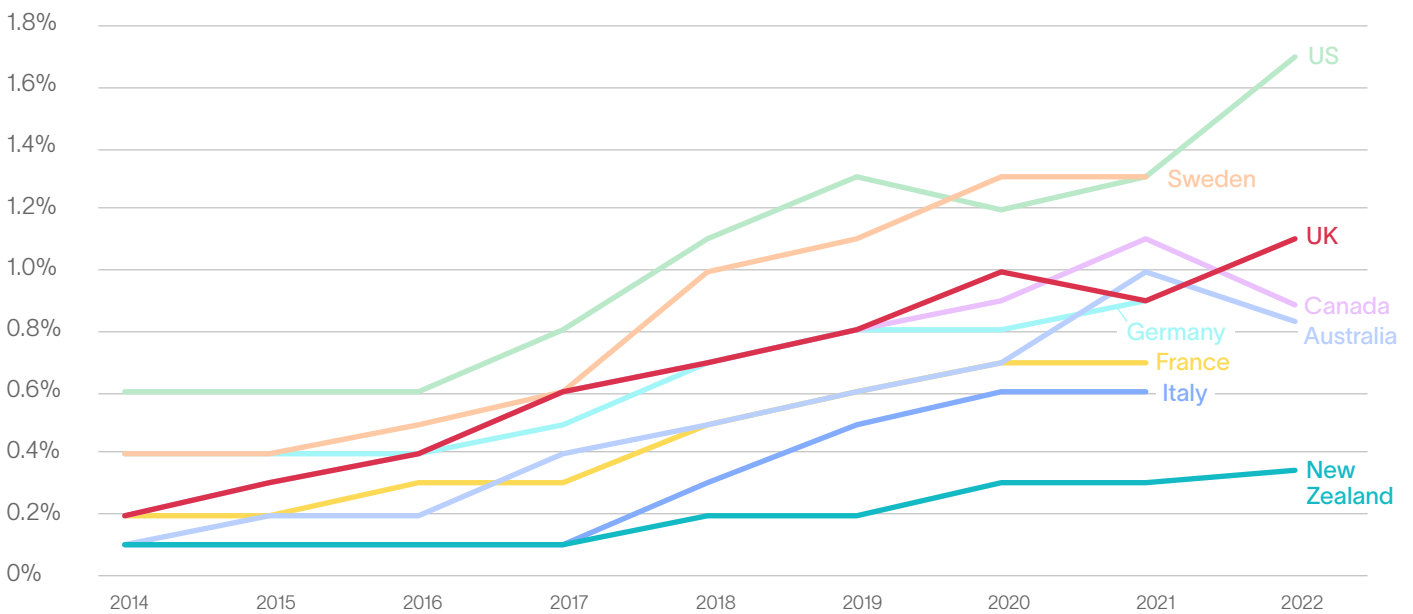
Of the countries shown, the US leads AI adoption with 1.7% of all job postings mentioning AI skills as a requirement in 2022, with Sweden following at 1.3% in 2021. As far as the UK labour market is concerned, the overall trend is similar to several other European countries, and it is currently third out of the nine shown with 1.1% of job postings mentioning AI skills in the first quarter of 2022.

On the following page, Figure 2 shows the data for the UK by itself going back to 2012, and there we see that over the nine year period the share of AI across all postings has increased threefold from approximately 0.3% in 2012 to close to 1% in 2021, with the upward trend continuing into the first quarter of 2022.
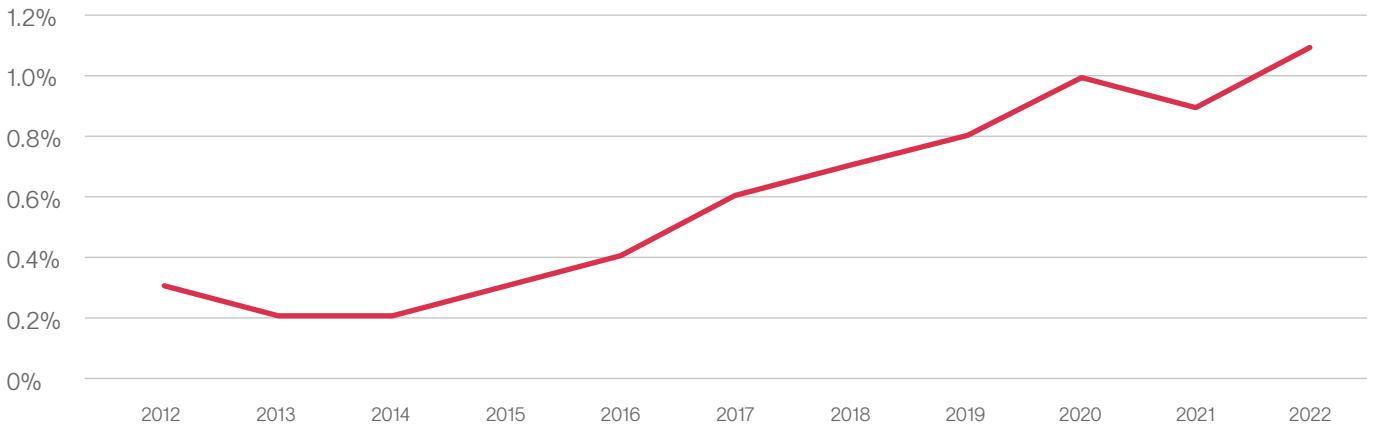
There are hundreds of different skills associated with AI in the labour market, and analysing demand for them individually is not particularly helpful in understanding what kinds of skills and technologies are most sought after in the workforce, or how that is changing over time. To make the data more useful in terms of analysing trends, we have grouped skills together into seven 'skills clusters', a complete list of which can be found in the Appendix. For example, rather than looking for demand trends for Speech Recognition and Text Mining, we have grouped them together with more than 20 similar skills under Natural Language Processing (NLP).

Figure 3 shows how demand for these seven clusters has changed since 2012, with job postings mentioning Machine Learning and Artificial Intelligence skills having grown the most, more than doubling their share of the overall labour market between 2016 and 2020. Demand in all areas of AI fell in 2020, perhaps due to the disruption during the Covid-19 crisis, but this may also potentially hint at a saturation of the market, or at a focus in the labour market on status quo job functions and less on innovative positions.

Figure 3: **Share of Total Postings by AI Skills Cluster, UK, 2012-Q1 of 2022**
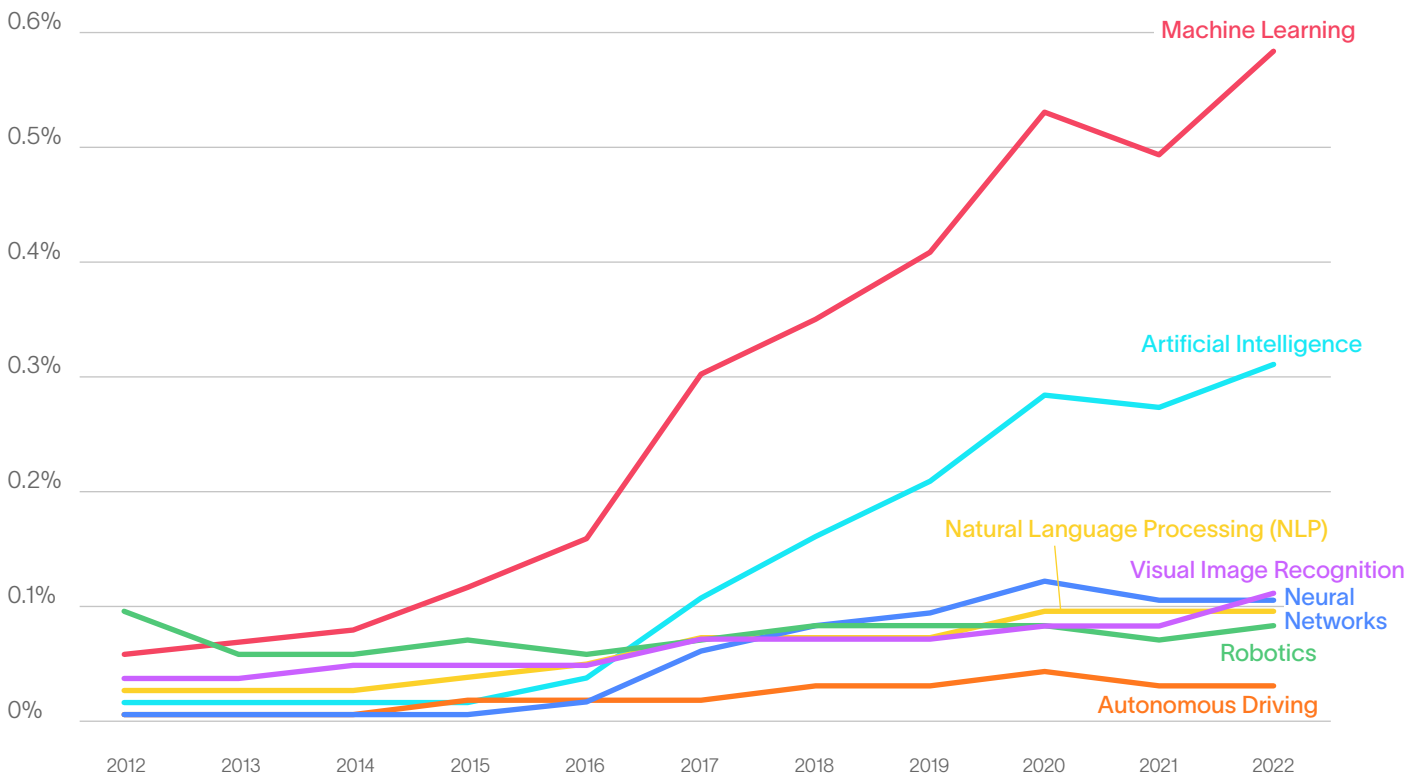
AI Diffusion by Industry and Region

In this section, we look at how demand for AI skills differs between industries and regions.

Figure 4 below shows the change in job postings for AI skills in the UK by sector from 2015 to 2021, using the 2-digit Standard Industry Classification (SIC 2). The data shows that Information and Communication has the highest share of AI, with 3.2% of all job postings relating to this industry referencing AI skills in 2021. This is followed by Finance and Insurance Activities (2.2%), and Professional, Scientific, and Technical Activities (3%).

The increase in the share of AI in industries between 2015 and 2021 illustrates the journey of AI. Almost all sectors have at least doubled their share, with the biggest changes seen in Wholesale and Retail, which had eight times more postings mentioning AI skills in 2021 than in 2015 (from 0.1% to 0.8%), followed by Administrative Support Service Activities with seven times more (from 0.1% to 0.7%). Manufacturing, on the other hand, has seen the slowest rate of growth, slipping from second place in the rankings in 2015 to fourth in 2021.

Figure 4: **Top AI Industries, 2021 vs 2015**
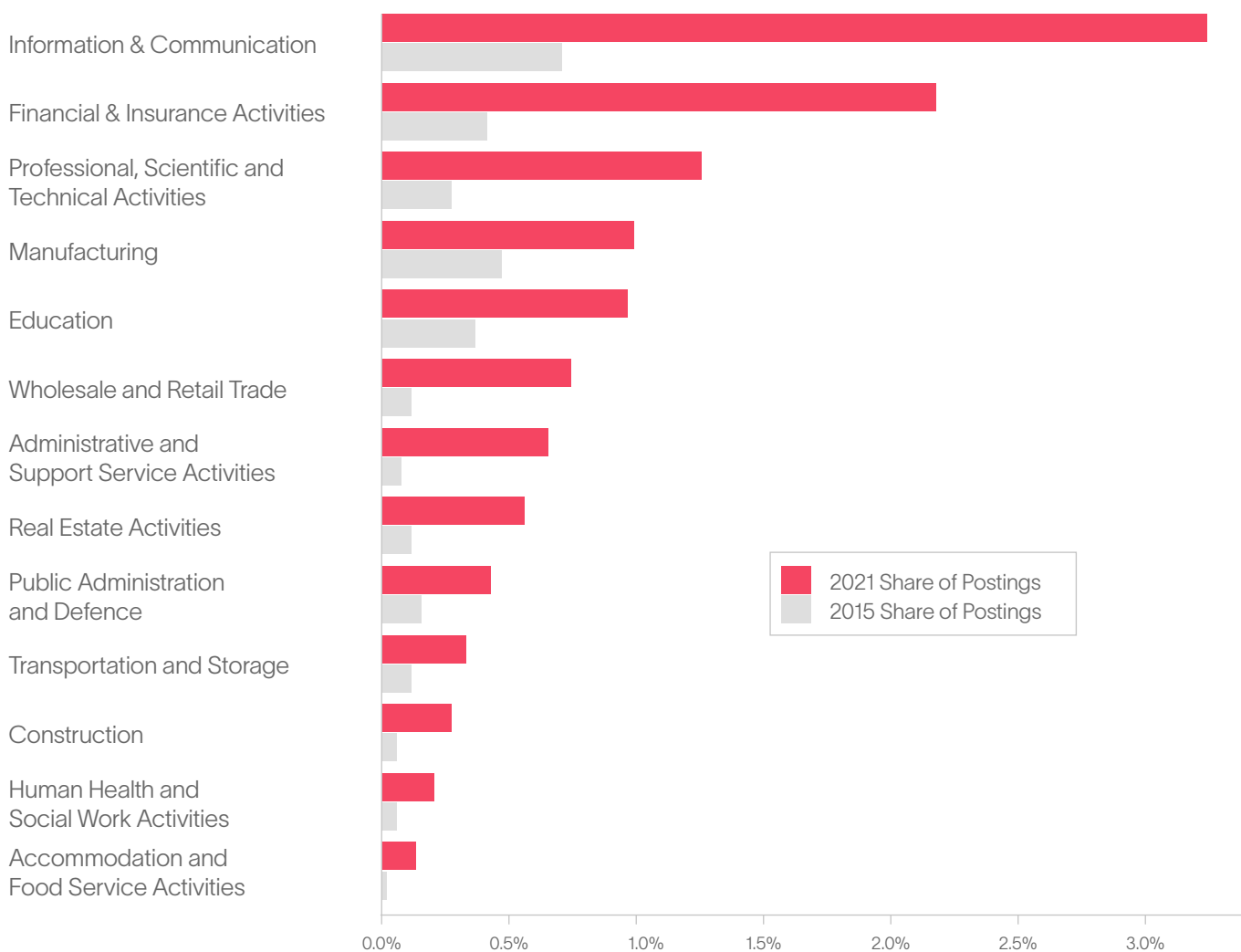
So far, we have looked at AI diffusion from the international and national perspective, but we can also drill down into the data to look at regional variations (please note, the accompanying interactive report, which can be viewed here, includes even more detailed data, down to county level).

As can be seen from the map below, the AI landscape looks fairly similar across the UK, but as we would expect Greater London, with its high concentration of IT and Finance, is dominant with AI skills appearing in 2.2% of all job postings. Far more surprising is that Northern Ireland ranks second, with a share of 1%, which may well be connected to the AI-related research activities at its two universities, Queen's University Belfast and Ulster University.

Figure 5: **AI Share of Total Postings (%) across the UK's NUTS 1 areas**
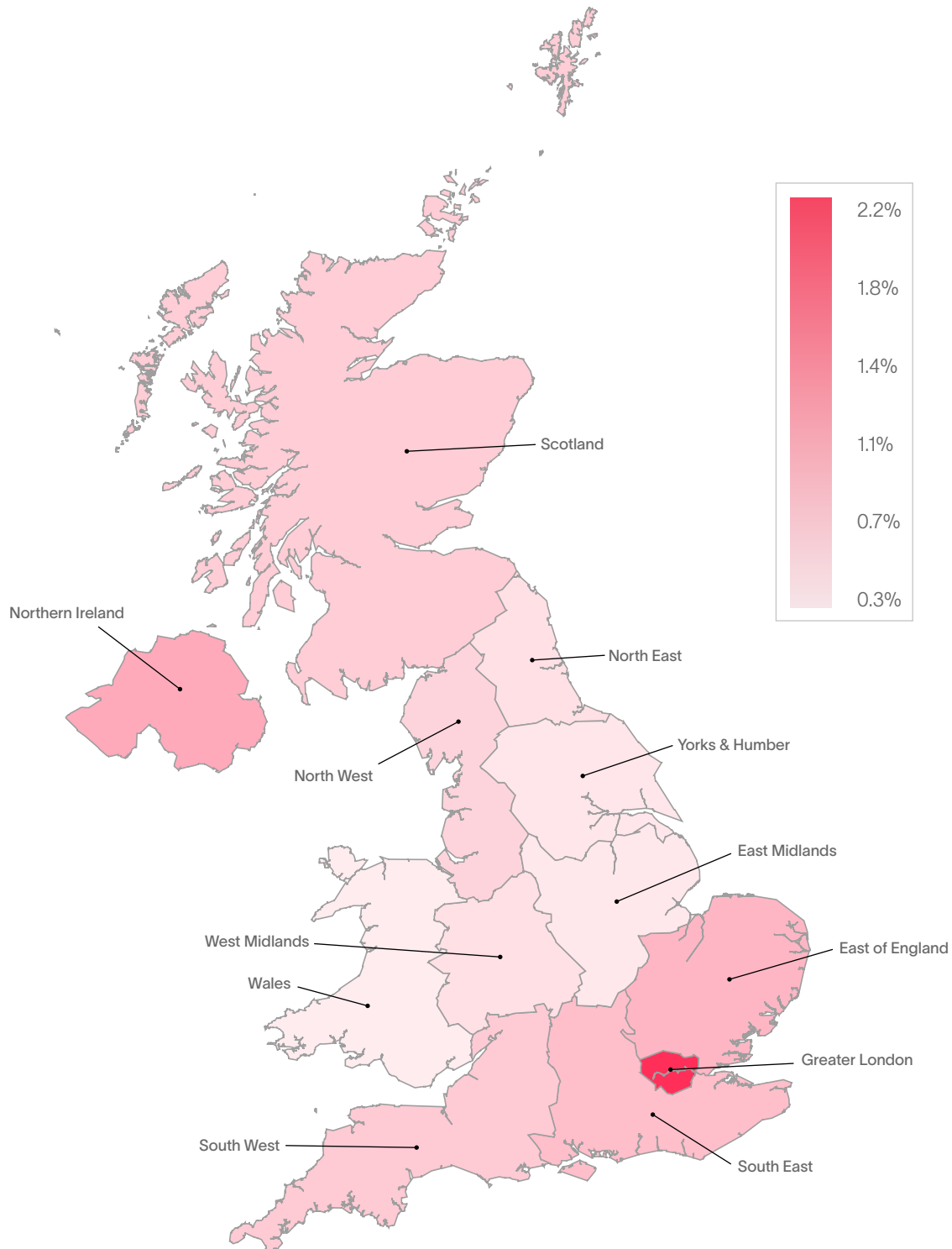
Getting even more granular, we can look at AI diffusion by Travel To Work Areas (TTWA) to reveal local hotspots. The map below shows areas of the country where the share of job postings mentioning AI is 0.5% or above, and the ones which have been labelled are those where the share exceeds 1.0%. Unsurprisingly, Cambridge, with its university, and science park employing over 7,000 people in over 130 companies, tops the list with 2.6% of all job postings mentioning AI skills. There are also a number of other locations that might readily spring to mind when considering where AI jobs are located, such as London (2.0%), with its vast IT and Finance sectors, and Oxford (1.93%) and Reading (1.14%), both of which have a strong concentration of tech companies.

The data also reveals a number of less obvious locations. For instance, the fourth hotspot in the UK is Andover in Hampshire, which may well be connected to it being the headquarters of the British Army Land Forces, whilst Coleraine in Londonderry – home to the Artificial Intelligence Research Centre at the University of Ulster – comes in at ninth place.

Figure 6: **TTWA Hotspots for AI Skills as a Share of Total Postings (%)**
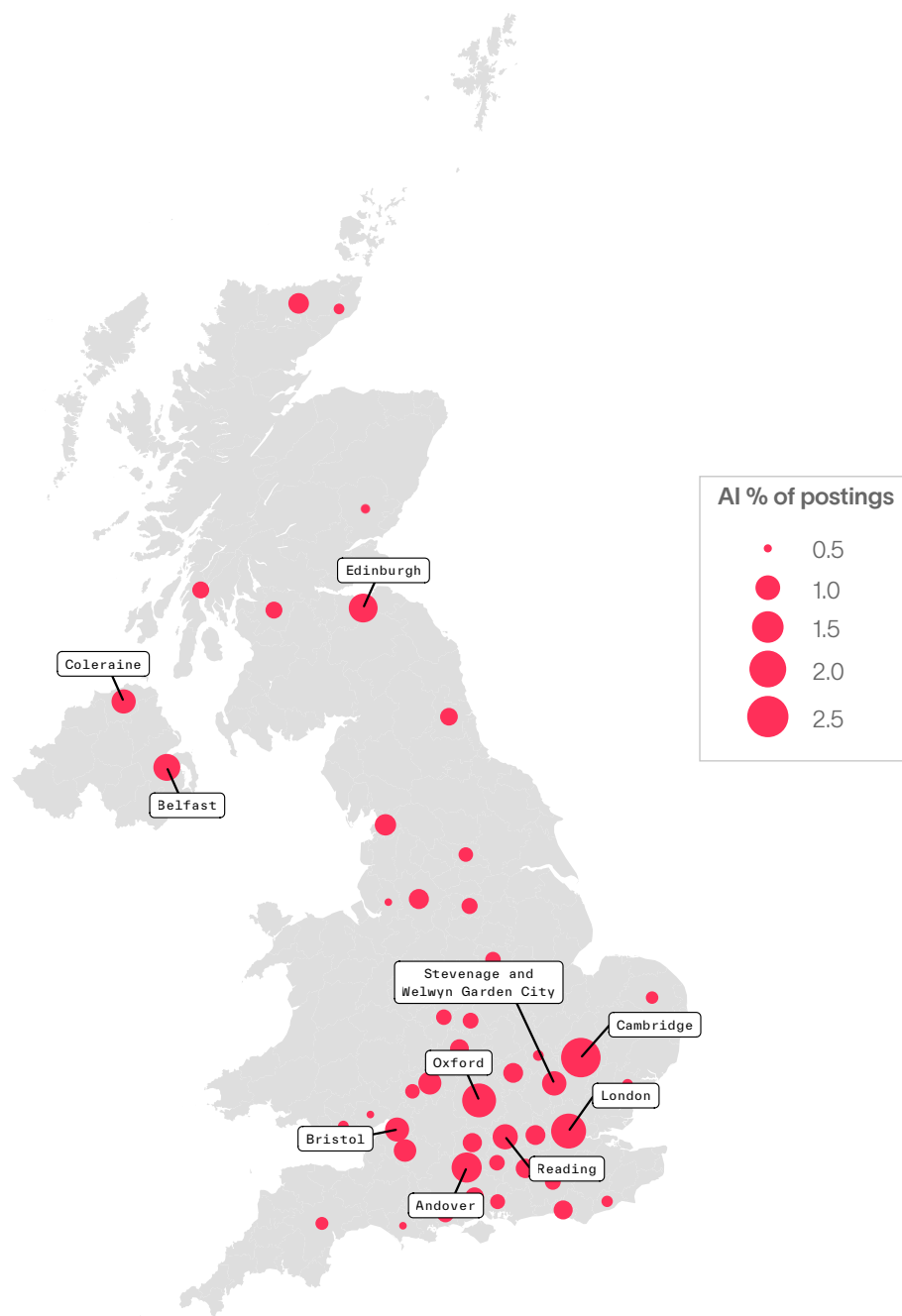
Occupations in the AI Market

In this section, we analyse the types of occupations that require AI skills, and how the landscape of occupations has changed over time.

Table 1 lists the top five occupations ranked by AI posting count and by change in rankings since 2012. At the top of the list by a considerable distance is Software Developer/Engineer, which has ranked number 1 since 2012, and which saw almost 18,000 postings in 2021 requesting AI skills. Next on the list is Data Scientist with over 7,000 postings requesting AI in 2021, followed by Computer System Engineer/Architect jobs (4,849 postings), and Data/Data Mining Analysts (3,778). What is also evident from the data is just how much change there has been over the last decade. Data Scientist, for instance, has moved up 33 places in the rankings since 2012 to reach second place in 2021, whilst Data Engineer has seen an even more dramatic increase having moved up 112 places over that time.

Table 1: **Top 5 Occupations Requesting AI Skills in 2021**

Occupation	Postings 2021	Rank Change since 2012
Software Developer/Engineer	17,951	0
Data Scientist	7,014	+33
Computer Systems Engineer/Architect	4,849	+11
Data/Data Mining Analyst	3,778	-1
Data Engineer	2,742	+112

As well as looking at occupation groups we can also look at job titles, particularly how the share of postings mentioning AI skills has changed over the past few years. Figure 7 below looks at the top ten job titles that have seen the biggest growth since 2015, and as you can see titles like Data Engineer and Machine Learning Engineer in particular have moved up significantly in the last six years. Figure 8 on page 12 looks at the opposite end of the spectrum – job titles where mentions of AI skills in job postings have declined over the past few years, and as you can see there have been declines in a number of engineering roles, as well as titles such as Information Analyst and Insight Analyst.

Figure 7: **Emerging Titles, 2021 vs 2015**
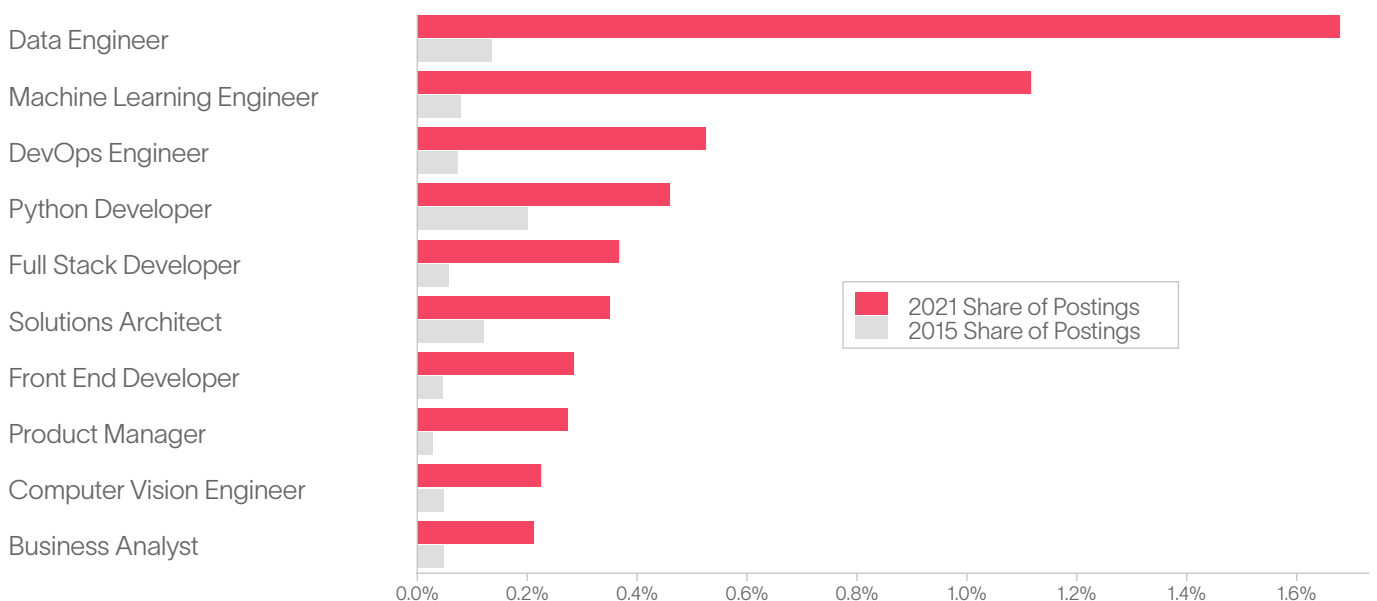
Only titles with a share larger than 0.2% of the total number of postings in 2021 are shown

Figure 8: **Disappearing Titles, 2021 vs 2015**

Systems Engineer
Control Systems Engineer
Maintenance Engineer
Mechanical Design Engineer
Information Analyst
Insight Analyst
Field Service Engineer

■ 2021 Share of Postings
□ 2015 Share of Postings

0.0%   0.1%   0.1%   0.1%   0.2%   0.2%   0.3%   0.4%

Only titles with a share larger than 0.2% of the total number of postings in 2015 are shown
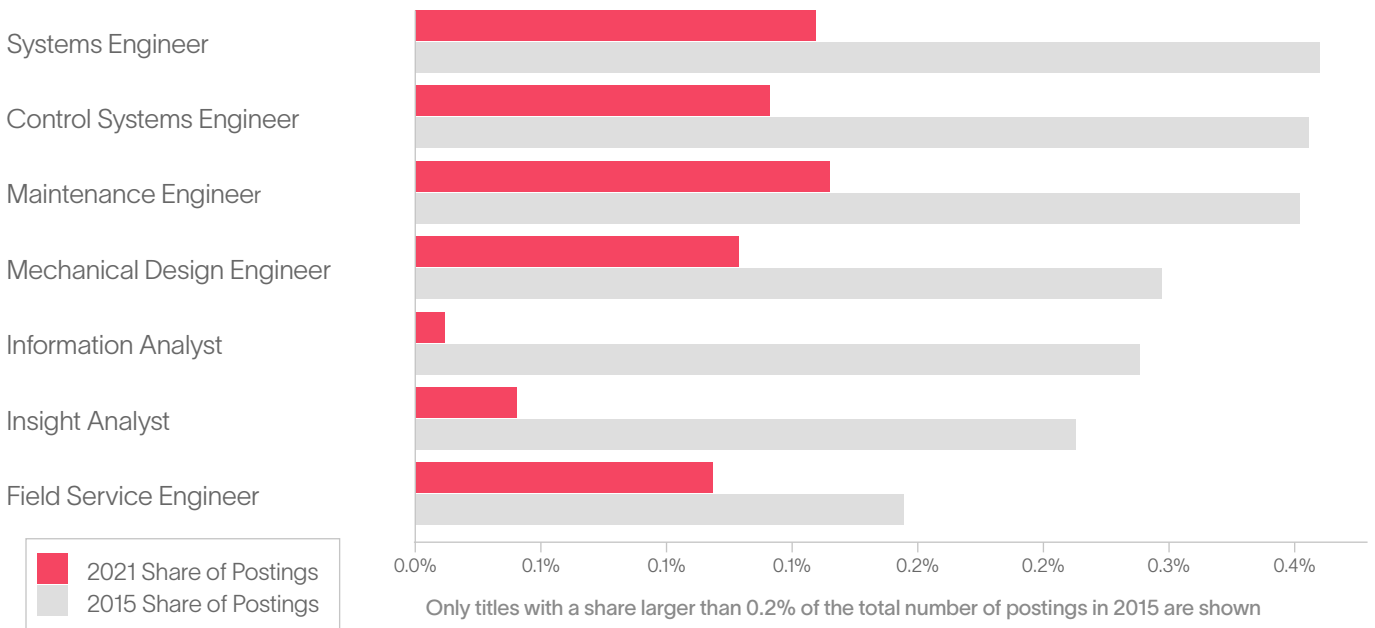
Finally in this section, we use the data to answer a fascinating question: is there any difference in the amount that job postings mentioning AI pay compared to postings for the same job which don't mention it? The answer is very clearly yes, as Figure 9 shows. In every one of the listed jobs, where AI is mentioned in the job posting the salary is higher th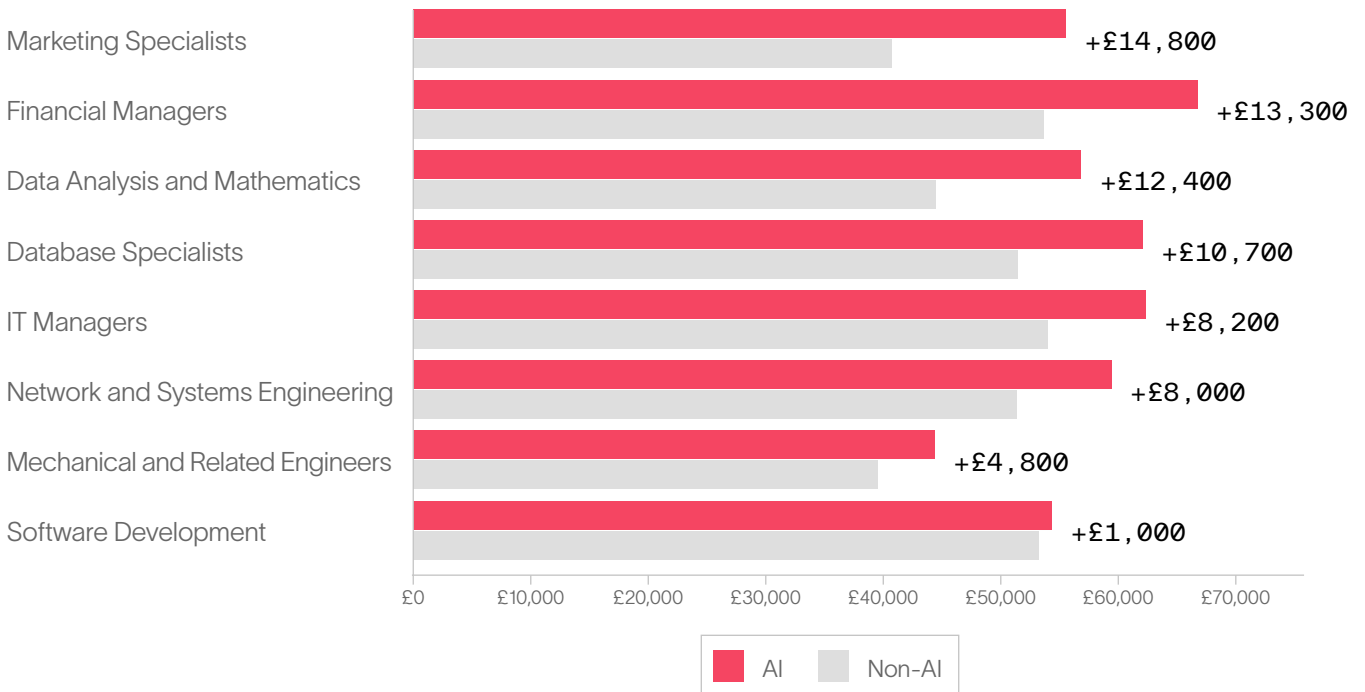an in those where it is not mentioned. The mark up is, however, clearer in some jobs than others. For example, both Marketing Specialist and Financial Manager roles see a significant pay rise when the job requires AI skills (+£14,800 and +£13,300, respectively). In Software Development jobs, however, the difference is just £1,000.

Figure 9: **Salary Premia by Occupation Group, 2021**

Marketing Specialists   +£14,800
Financial Managers   +£13,300
Data Analysis and Mathematics   +£12,400
Database Specialists   +£10,700
IT Managers   +£8,200
Network and Systems Engineering   +£8,000
Mechanical and Related Engineers   +£4,800
Software Development   +£1,000

£0   £10,000   £20,000   £30,000   £40,000   £50,000   £60,000   £70,000

■ AI   □ Non-AI

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[4] Occupation group salaries are weighted averages of the occupations in each occupation group. The percentage of postings for each occupation in its occupation group has been used as weights in order to avoid large occupations skewing the group wide average.
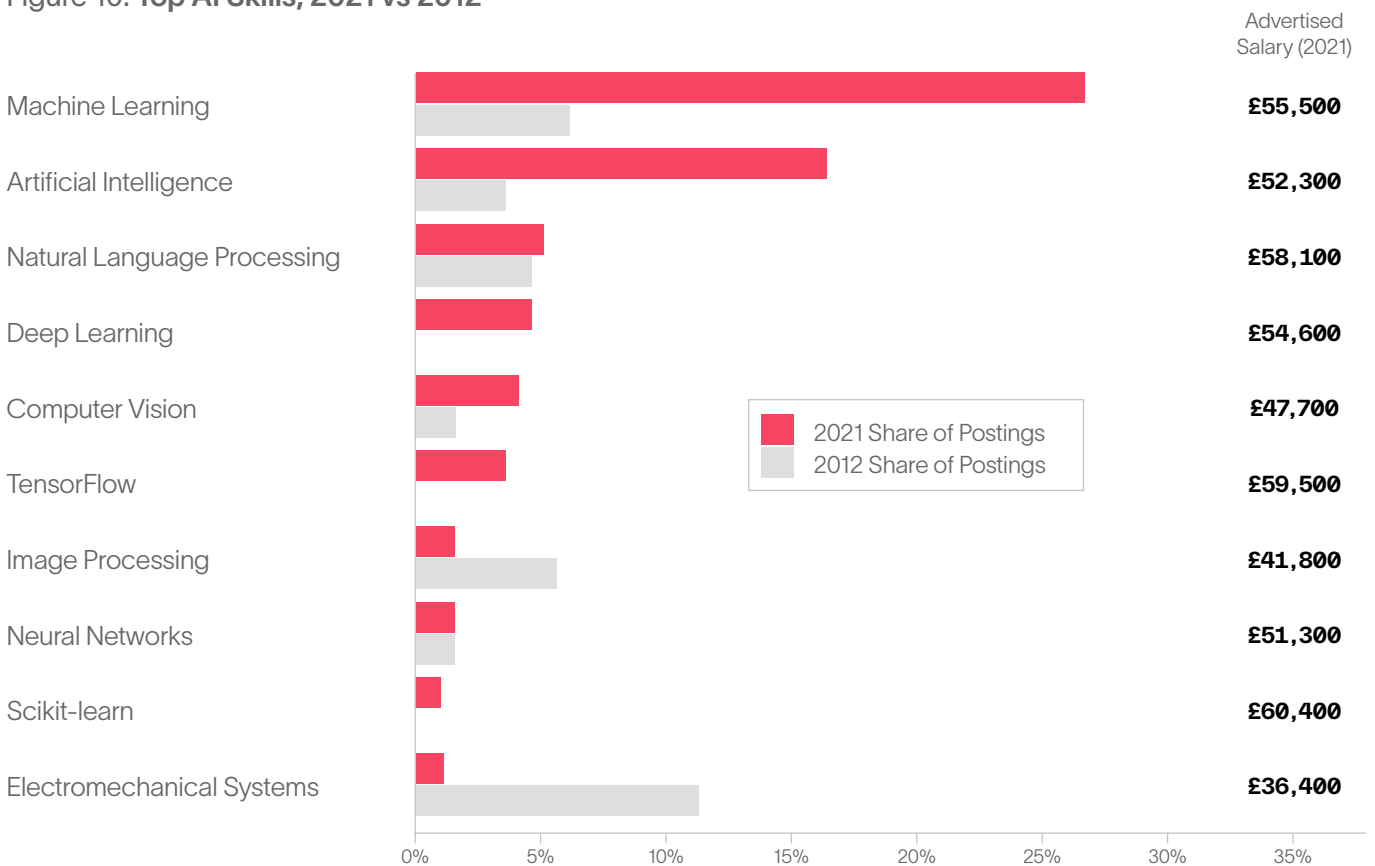

Skills in the AI Market

In this section we examine the skills required by AI jobs to help give us a deeper understanding of what employers are looking for.

The most commonly requested AI skills that employers specifically ask for are Machine Learning, with around 47,000 postings in 2021 (50% of all AI postings), and Artificial Intelligence, which has 27,000 postings (29%). Several skills like NLP, Computer Vision, Image Processing, and Neural Networks are well established in the Top 10

AI skills. Deep Learning, on the other hand, is an example of a skill that has seen explosive growth in demand, moving up 36 ranks since 2012.

Other skills such as TensorFlow and Scikit-learn have also entered the market in the last few years, and we can see just how valuable they are to employers by the fact that they command the highest advertised salaries of these top skills, at £60,400 and £59,500, respectively.

Figure 10: **Top AI Skills, 2021 vs 2012**

Advertised Salary (2021)

Skill	Salary
Machine Learning	**£55,500**
Artificial Intelligence	**£52,300**
Natural Language Processing	**£58,100**
Deep Learning	**£54,600**
Computer Vision	**£47,700**
TensorFlow	**£59,500**
Image Processing	**£41,800**
Neural Networks	**£51,300**
Scikit-learn	**£60,400**
Electromechanical Systems	**£36,400**

Legend: 2021 Share of Postings / 2012 Share of Postings

X-axis: 0% 5% 10% 15% 20% 25% 30% 35%

In addition to actual AI Skills, we can also complete the skill profile for AI jobs by looking at both technical and human skills. Overleaf, Figure 11 shows that Python is the most widely used programming language with around 34,000 job postings in 2021, having grown significantly in popularity over the last ten years, moving up 18

ranks between 2012 and 2021. Figure 12 then shows the top human skills mentioned in AI-related job postings, and as you can see skills such as communication, teamwork, research, problem solving, and creativity are seen as critical parts of being able to perform a job involving AI.
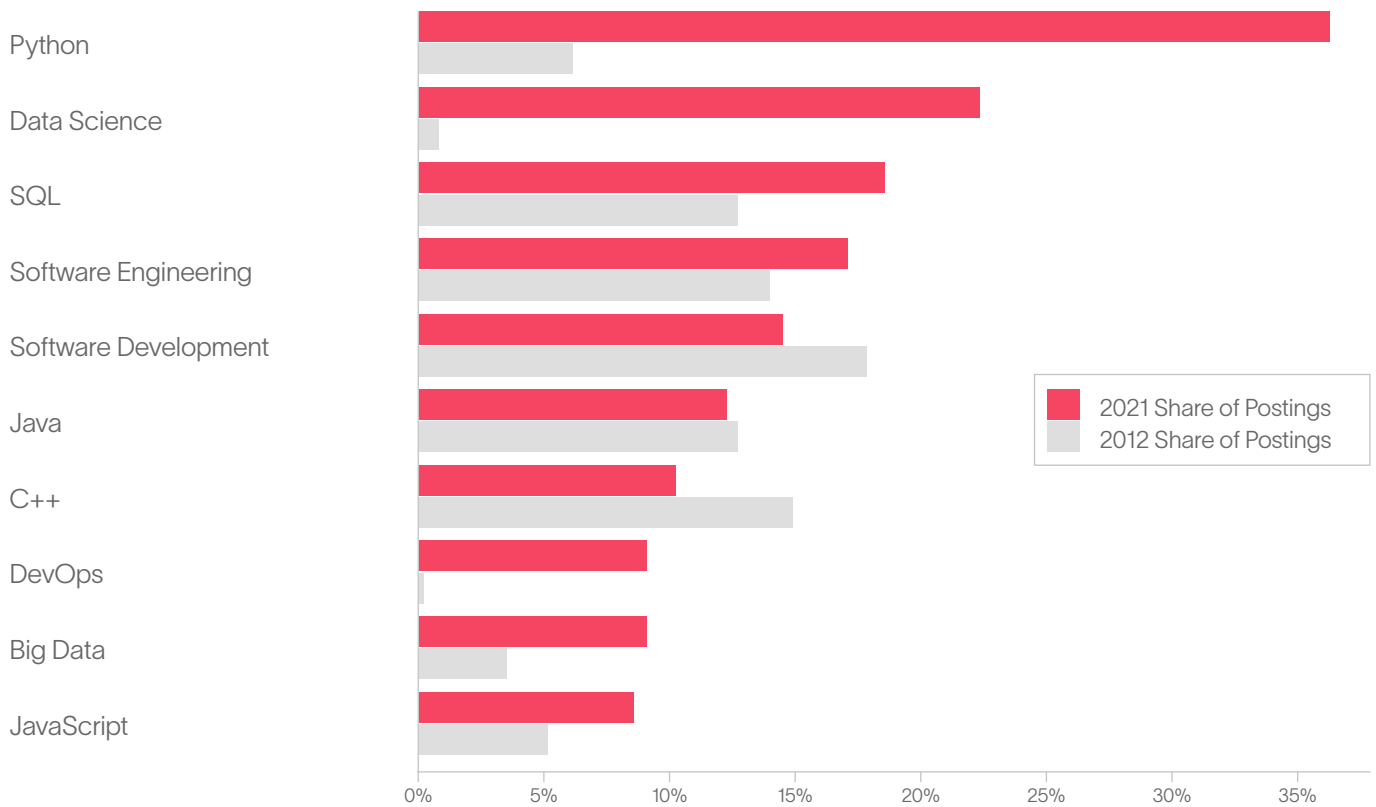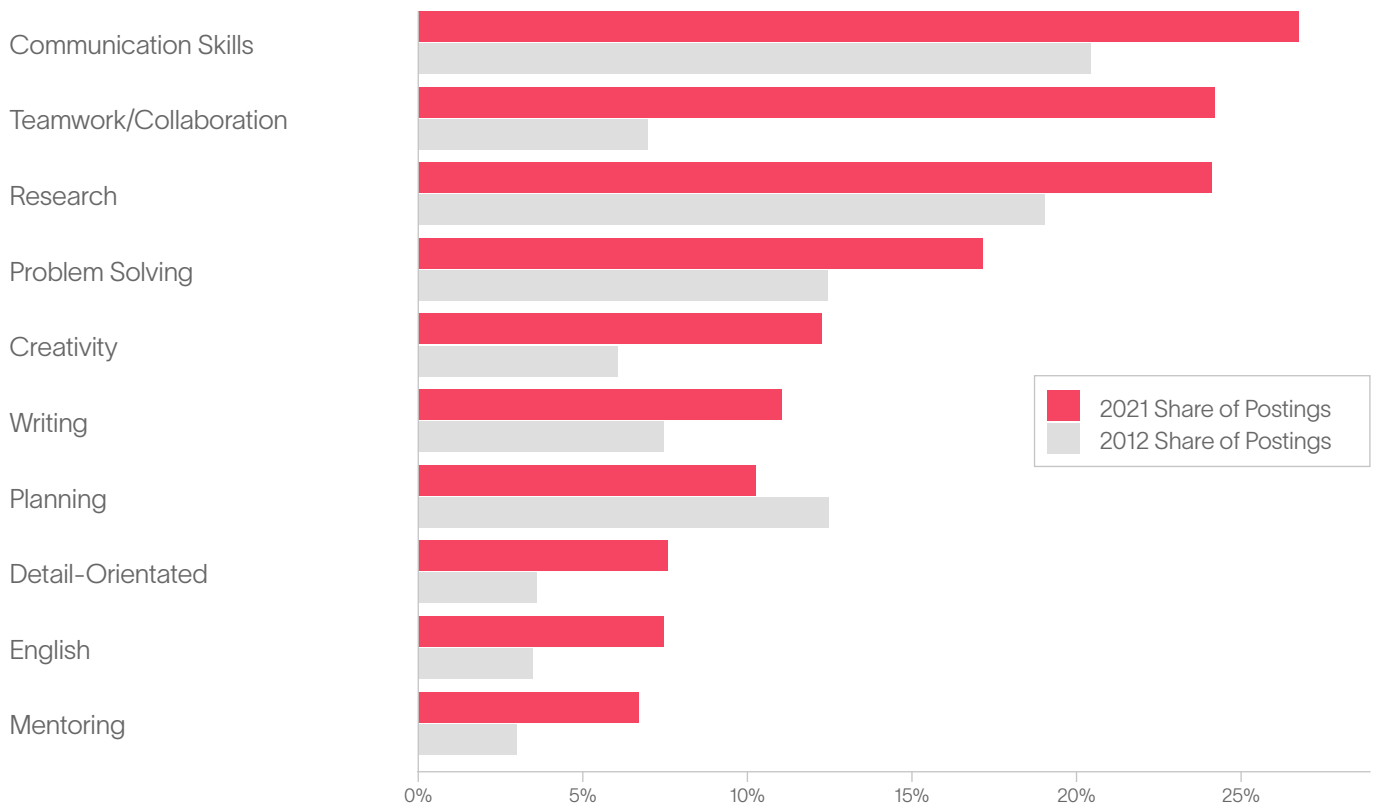
Figure 11: Top Technical Skills, 2021 vs 2012

Python
Data Science
SQL
Software Engineering
Software Development
Java
C++
DevOps
Big Data
JavaScript

Legend: 2021 Share of Postings / 2012 Share of Postings

X-axis: 0% 5% 10% 15% 20% 25% 30% 35%

Figure 12: Top Human Skills, 2021 vs 2012

Communication Skills
Teamwork/Collaboration
Research
Problem Solving
Creativity
Writing
Planning
Detail-Orientated
English
Mentoring

Legend: 2021 Share of Postings / 2012 Share of Postings

X-axis: 0% 5% 10% 15% 20% 25%

Finally in this section, we can see how technical skills related to AI jobs travel well across industries, with the skills profile changing only slightly when changing sectors. Figure 13 looks at the top five technical skills across five industries – IT, Mining and Quarrying, Finance, and Manufacturing. As you can see, although there are some industry-specific skills that stand out, such as Robotics and Mechanical Engineering in Manufacturing, and Energy Solutions in Mining & Quarrying, there are also a number of skills that are prevalent in all four industries, such as Python, Data Science, and Software Engineering. What this shows is that these are highly transferable skills, and those who have them are therefore likely to have significant career opportunities across a number of sectors.

Figure 13: **Top 5 Specialised Skills Across four Industries**
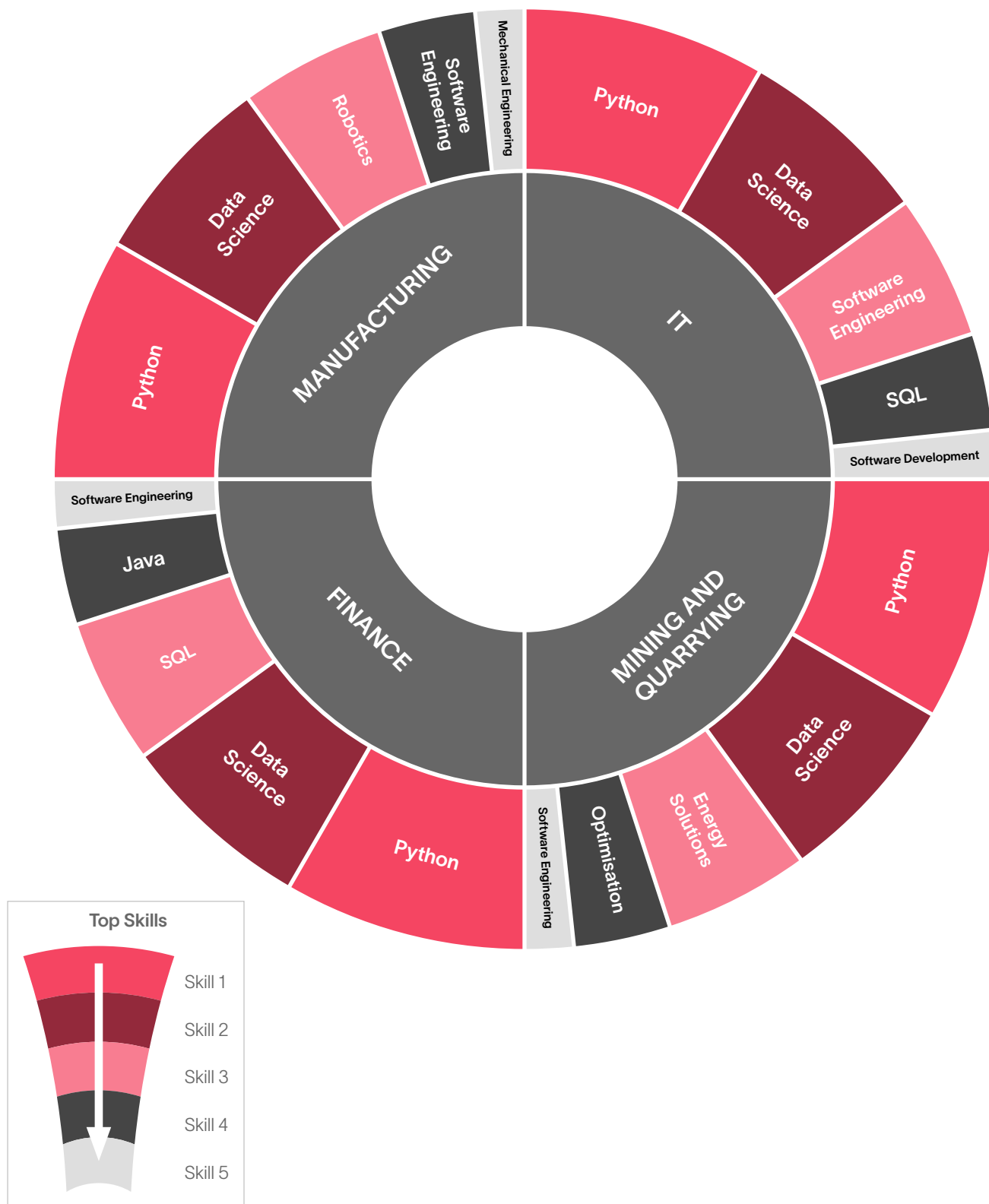
Conclusion

As this report shows, the importance of AI skills to UK employers has grown significantly over the past decade, putting the nation amongst the leading countries in the world in terms of AI adoption. However, as we noted in the Introduction, if the government's commitment to making the UK a global AI superpower over the next decade is to be realised, and if this is to benefit all sectors and regions, it will need to be underpinned by a strong evidence-based approach to understanding labour market demand for AI skills.

This report has been an attempt to provide such an evidence-based approach, but perhaps even more importantly the data and analysis it contains demonstrates *why* this is so vital.

In the section on industries, for example, we saw that although demand has been strongest in the sector we might have expected - Information and Communication - there has actually been growth across all sectors. In the section on regional diffusion, we saw areas we might have expected to have high demand, such as London and Cambridge, but the data also highlighted areas of high demand which are not so obvious, such as Northern Ireland, Andover, and Coleraine.

In the more detailed data you can find at our **accompanying interactive report**, the point becomes even clearer. When we look at the top occupations requiring AI skills, for instance, we find Software Developer/Engineer and Data Scientist appearing in the top fives for all regions and countries. Below that, however, there are some interesting differences. Data Engineer, for example, only appears in the top five in Greater London and the North West, whilst Medical Scientist appears in the top five in East Midlands and Wales.

This report has also highlighted how acquiring AI skills can make people more employable, since they are very often transferable across different industries and occupations, as well as more prosperous, with jobs postings that include these skills found to pay more than postings for the same jobs which don't mention them. Again, this data-driven approach is vital for any strategy for growing AI, since it can be used to encourage people to learn AI skills, as well as help inform education providers as to what skills are needed.

The data therefore serves to both confirm and challenge our assumptions, and this is why any strategy aimed at investing and planning for the long-term needs of an AI-enabled economy needs to take these sorts of nuances into account. If the National AI Strategy is to be a success, and if public money is to be used to support an increase in the training of AI skills which genuinely benefits all sectors and all regions, understanding *what* skills are needed, *which* sectors require them, and *where* they are in-demand will be vital.

Appendix

List of AI skills and the skills clusters we have grouped them into:

Artificial Intelligence:
Expert System, IBM Watson, IPSoft Amelia, Ithink, Virtual Agents, Artificial Intelligence.

Autonomous Driving:
Autonomous Systems, Lidar, OpenCV, Path Planning, Remote Sensing.

Natural Language Processing (NLP): ANTLR, Automatic Speech Recognition (ASR), Chatbot, Computational Linguistics, Distinguo, Latent Dirichlet Allocation, Latent Semantic Analysis, Lexalytics, Lexical Acquisition, Lexical Semantics, Machine Translation (MT), Modular Audio Recognition Framework (MARF), MoSes, Natural Language Processing, Natural Language Toolkit (NLTK), Nearest Neighbour Algorithm, OpenNLP, Sentiment Analysis/Opinion Mining, Speech Recognition, Text Mining, Text to Speech (TTS), Tokenization, Word2Vec.

Neural Networks: Caffe Deep Learning Framework, Convolutional Neural Network (CNN), Deep Learning, Deeplearning4j, Keras, Long Short-Term Memory (LSTM), MXNet, Neural Networks, Pybrain, Recurrent Neural Network (RNN), TensorFlow.

Machine Learning: AdaBoost algorithm, Boosting (Machine Learning), Chi Square Automatic Interaction Detection (CHAID), Classification Algorithms, Clustering Algorithms, Decision Trees, Dimensionality Reduction, Google Cloud Machine Learning Platform, Gradient boosting, H2O (software), Libsvm, Machine Learning, Madlib, Mahout, Microsoft Cognitive Toolkit, MLPACK (C++ library), Mlpy, Random Forests, Recommender Systems, Scikit-learn, Semi-Supervised Learning, Supervised Learning (Machine Learning), Support Vector Machines (SVM), Semantic Driven Subtractive Clustering Method (SDSCM), Torch (Machine Learning), Unsupervised Learning, Vowpal, Xgboost.

Robotics: Blue Prism, Electromechanical Systems, Motion Planning, Motoman Robot Programming, Robot Framework, Robotic Systems, Robot Operating System (ROS), Robot Programming, Servo Drives/Motors, Simultaneous Localization and Mapping (SLAM).

Visual Image Recognition:
Computer Vision, Image Processing, Image Recognition, Machine Vision, Object Recognition.

Methodology and Data

To support these analyses, Lightcast mined its dataset of millions of job postings collected since 2010. Lightcast collects postings from over 45,000 online job sites worldwide, aggregating them, removing duplicates, and extracting data from the text to create a comprehensive, real-time portrait of labour market demand. This includes information on job titles, employers, industries, and regions, as well as required experience, education, and skills.

In order to measure employer demand for AI skills, we used a combination of Lightcast skills and keyword searches to find AI skills in job posting data. The list of AI skills from our data is shown in the Appendix, with associated skill clusters, which include Artificial Intelligence, Neural Networks, Autonomous Driving, Natural Language Processing, Machine Learning, Robotics, and Visual Image Recognition. While some skills are considered to be in the AI cluster specifically, for the purposes of this report, all skills in associated clusters were considered AI skills, and a job posting was considered an AI job if it mentioned one or more of these keywords. As a posting typically has several skills, it can therefore also have several skill clusters, so for the purposes of comparing different skill clusters of AI in the labour market, some postings have been counted several times – once for each skill cluster that is mentioned in the job text.

About the Authors

Bledi Taska

Bledi Taska is Chief Economist and Executive Vice President of Corporate Economics at Lightcast. He is a labour economist specialising in the application of econometrics and statistics on real time labour market data. At Lightcast, Bledi leads a team of economists and data scientists, which supports the company's public policy research, product development, and collaboration with academic researchers and international organisations.

He received a Doctorate degree in Economics from New York University and a Bachelor's degree in Economics from the University of Athens, Greece. He has presented his academic research at Stanford University, Indiana University, IFO Institute, IZA Institute of Labor Economics, the Association for the Advancement of Artificial Intelligence, the Atlanta FED, the European Association of Labour Economists, and the Midwest Economics Association.

Layla O'Kane

Layla O'Kane is a Research Director on the Economics team at Lightcast, where she manages projects that use labour market analytics to further public policy. Recent research topics include understanding the career pathways available to vulnerable workers displaced by automation, closing the digital skills gap across workers, entrepreneurship and career opportunities for military spouses, and the return on investment of industry credentials. Layla has had the opportunity to present her work at conferences organised by the UN, OECD, APEC, and SXSWEdu.

Layla holds a BA in Economics and in International Relations from the University of Pennsylvania and an MPA in International Development from the Harvard Kennedy School.

Julia Nania

Julia Nania is a Research Lead at Lightcast, focusing on labour market analysis in Europe. Topics that she has worked on include digitalisation of the labour market, cyber security, and artificial intelligence. Her experience at Lightcast also includes taxonomy management as well as development of data quality processes.

Julia holds a Bachelor's degree in European Economic Studies from the University of Bamberg and a Master's degree in Business Management from the University of Würzburg.

Lightcast

ABOUT LIGHTCAST

Lightcast is the world's leading authority on job skills, workforce talent, and labour market dynamics. Organisations across the globe use our market research, analytical software, and data expertise to better understand their own workforce and identify skilled and diverse talent for future growth.

Headquartered in Boston, Massachusetts, and Moscow, Idaho, Lightcast is active in more than 30 countries and has offices in the United Kingdom, Italy, New Zealand, and India.

Check out the interactive dashboard we've created with the visual data storytellers, Infogr8, which offers even more detailed insights of demand for AI at the local level:

https://aiskills.lightcast.io/

Contact

www.lightcast.io/uk

uk-info@lightcast.io