

Which (set of) skills to work with AI?, Friday 5th February 2021

#OECD AI

THE HUMAN CAPITAL BEHIND AI

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OECD Directorate for Science, Technology and Innovation



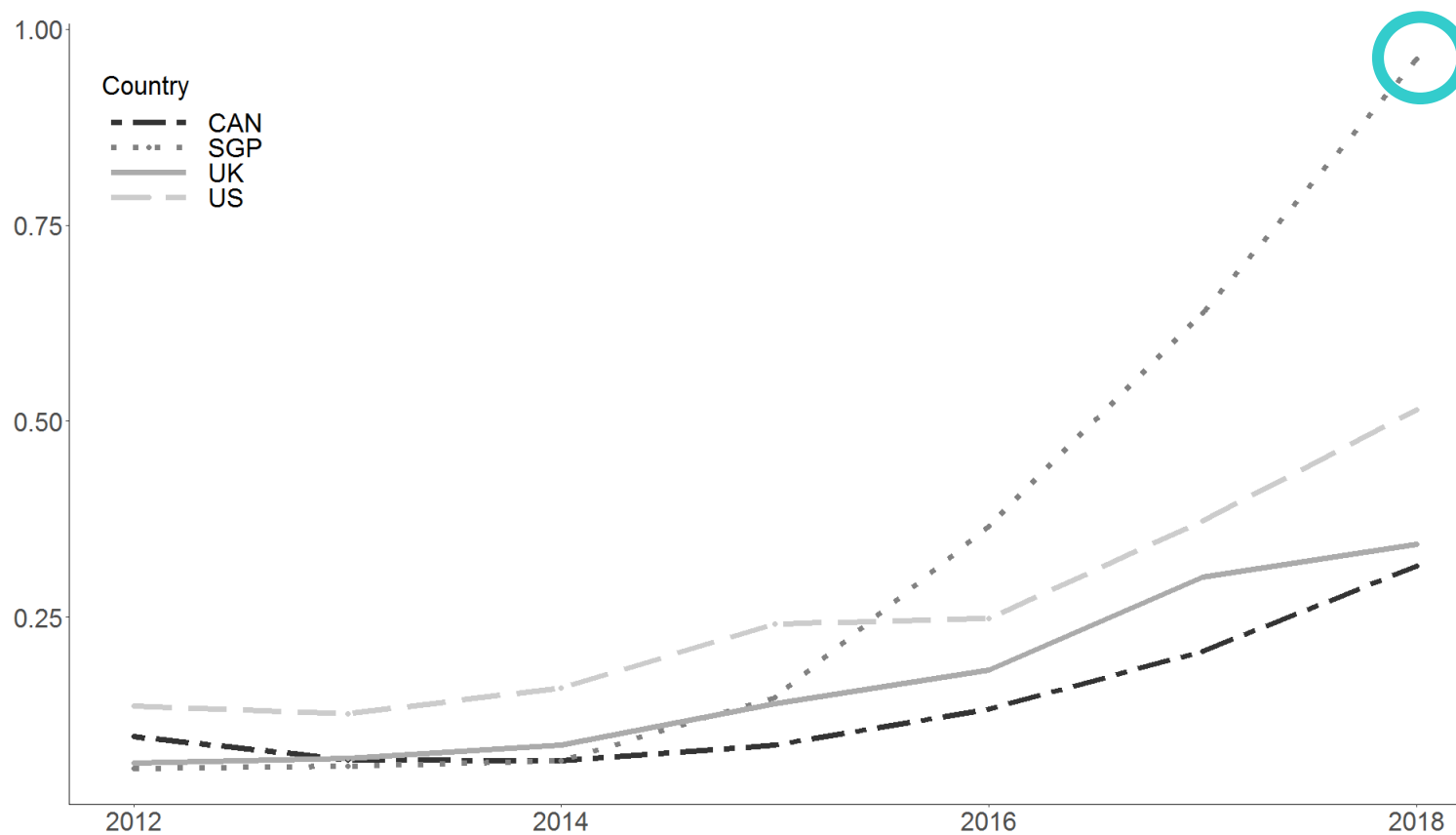
* Based on work with: Mariagrazia Squicciarini, Heike Nachtigall and Emile Cammeraat

**International Conference on
AI in Work, Innovation, Productivity and Skills**
1-5 February 2021





SHARE OF AI-RELATED JOBS IN BGT, BY COUNTRY AND YEAR



AI-related vacancies are identified using

- 1) the list of AI-related keywords of [Baruffaldi et al. \(2020\)](#) and
- 2) a list of AI-related software and repositories validated by experts at UK BEIS.

“AI-related” jobs are those featuring at least two AI-related skills belonging to different concepts or methodologies in the online job description.

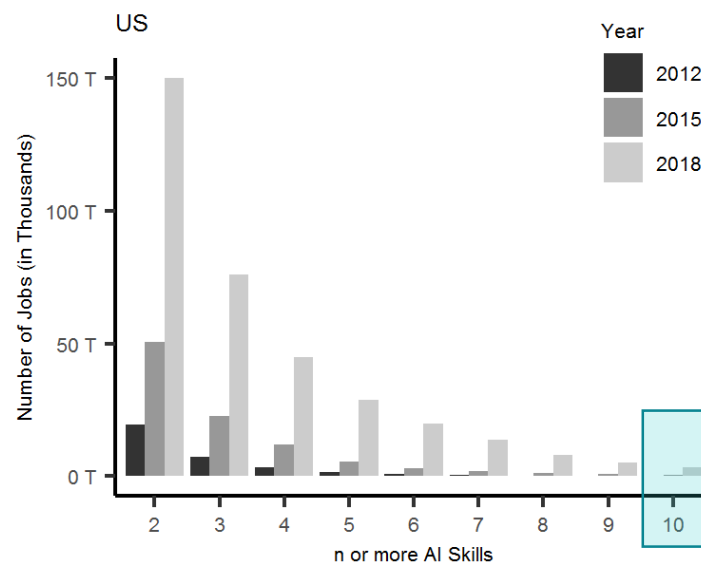
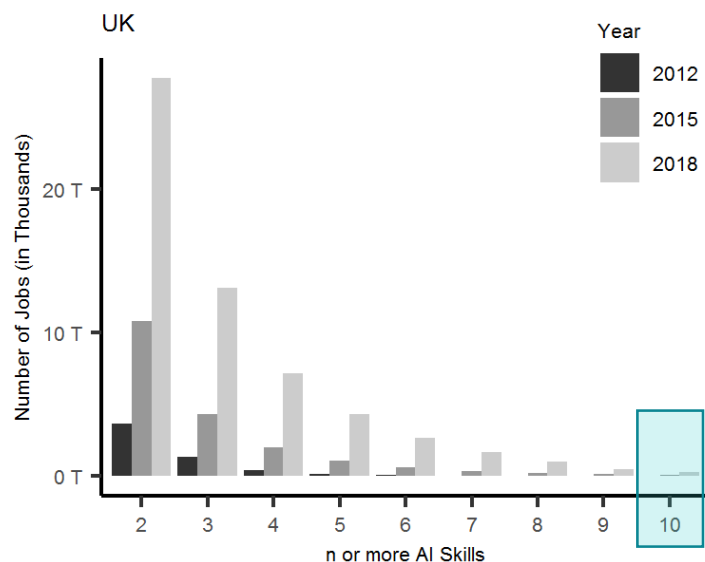
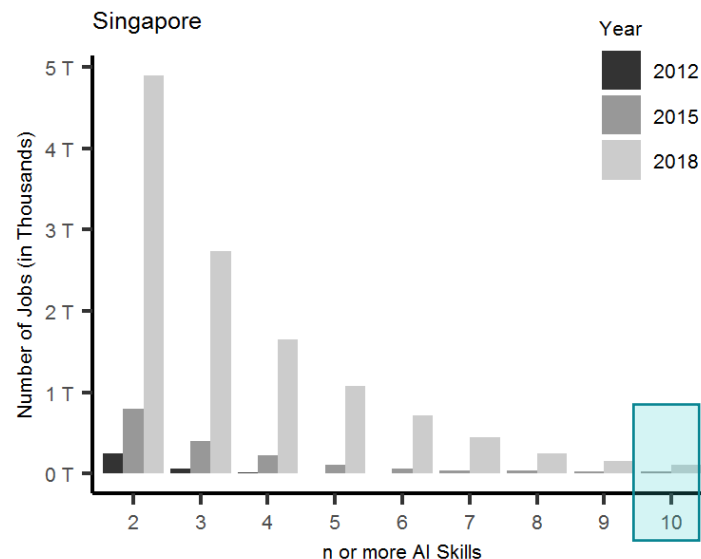
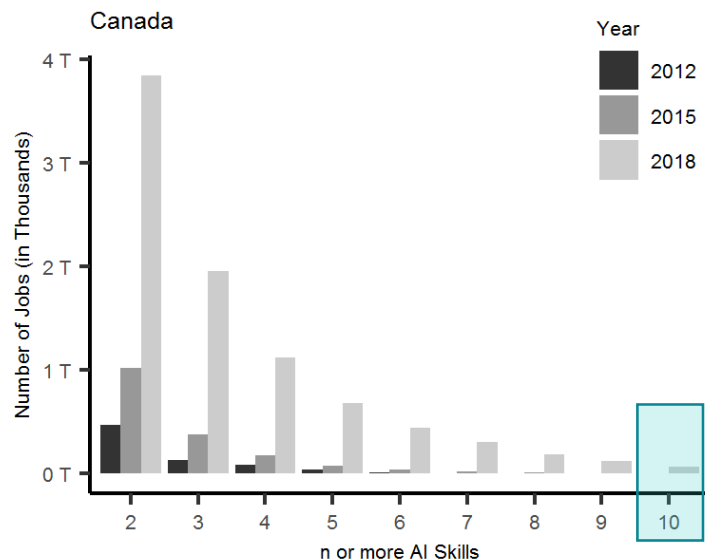
One of these keywords may or may not be a software-related skill.

Note: The database lacks job postings from the United Kingdom for December 2018.

Source: Nachtigall and Squicciarini (forthcoming). Authors' own compilation based on [BGT](#) data.



HOW MANY AI-RELATED SKILLS ARE DEMANDED IN AI-RELATED JOBS?



FREQUENCY, JOBS REQUIRING 2 OR MORE AI-RELATED SKILLS

The total number of **AI-related jobs** increased over time.

A **growing number** of jobs requires a **growing number of AI-related skills**.

In all countries considered in the analysis, the overall **average share of AI software-related skills** increased between 2012 and 2018.

Note: The database lacks job postings from the UK for December 2018.

Source: Nachtigall and Squicciarini (forthcoming). Authors' own compilation based on [BGT](#) data.

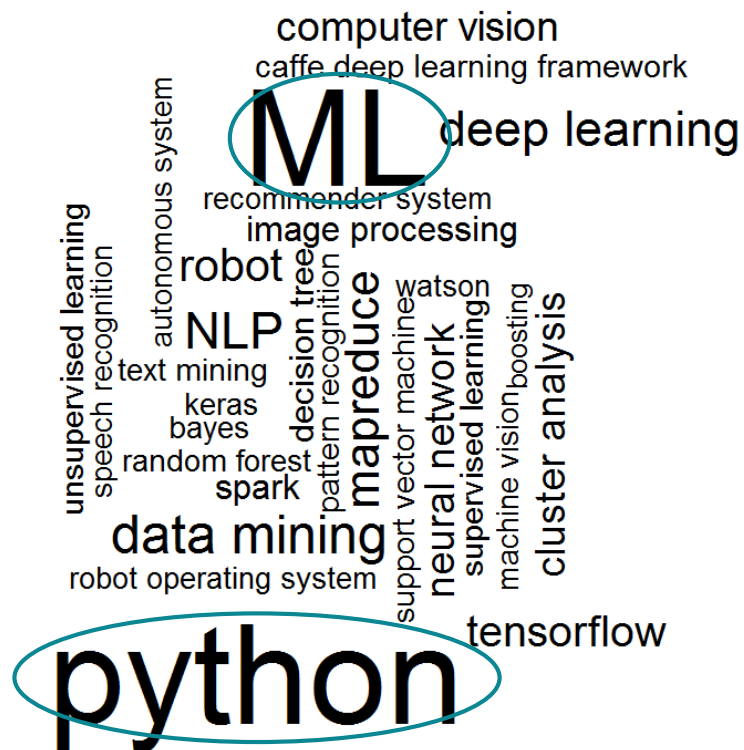


WHICH SKILLS ARE DEMANDED IN AI-RELATED JOB ADS ?

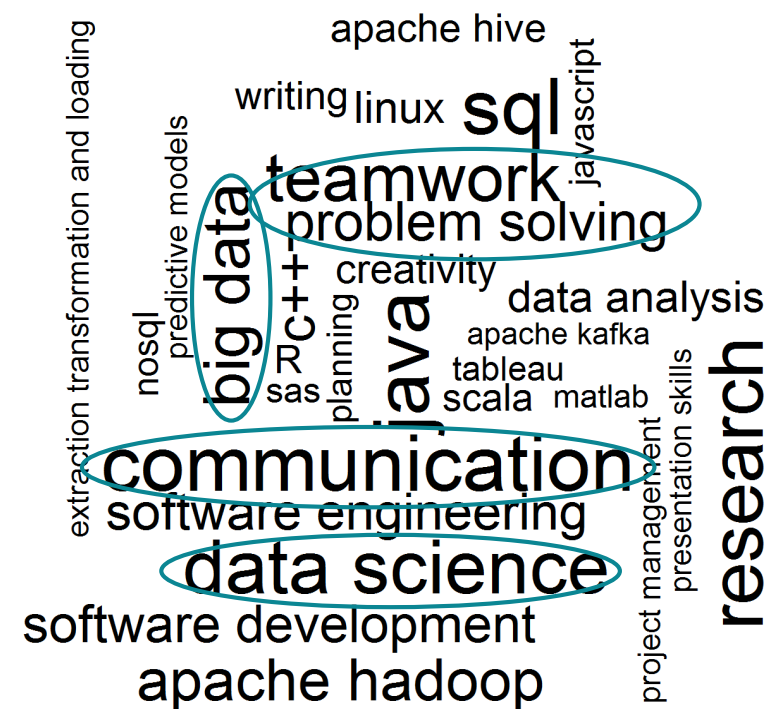
Over time, we observe an **increase in demand** for some specific **technical** and **socio-emotional** skills.

Machine Learning and **Python** continue to be frequently demanded, but the picture is **more balanced** in terms of specific AI-related skills compared to 2012.

TOP 30 AI-RELATED SKILLS 2018



TOP 30 NON-AI-RELATED SKILLS 2018



Note: In 2012 and 2018, the frequency of the top 30 AI-related skills accounts for around 98% and 96%, respectively, of the frequency of all AI-related skills. The frequency of the top 30 non-AI skills accounts for around 31% of the frequency of all non-AI skills in both years. Source: Nachtigall and Squicciarini (forthcoming). Authors' own compilation based on [BGT](#) data.



HOW ARE THESE SKILLS LINKED?

Functional to programming

Robotics

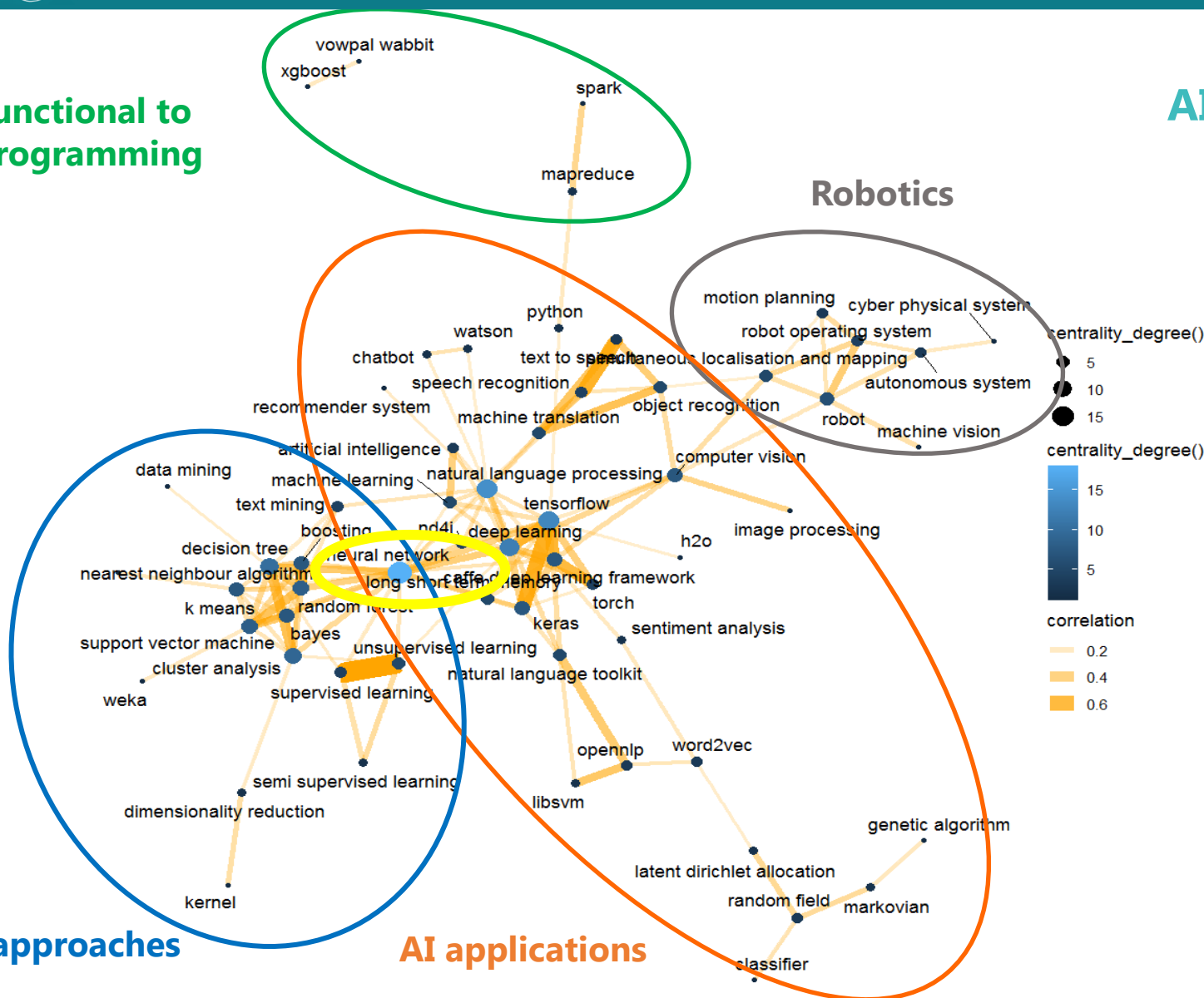
AI-RELATED SKILLS IN AI-RELATED JOBS, US

Network of skills, Corr>0.1, 2017-19

- Skill bundles are interrelated;
- Central node: Neural networks;
- A methodological / core developments part of the network, advancing AI itself, emerges (blue);
- An application-related part of the cluster emerges (orange);
- A robotics-related part of the cluster emerges (grey);
- Support functions / software bundles of skills emerge (green)

Core approaches

AI applications

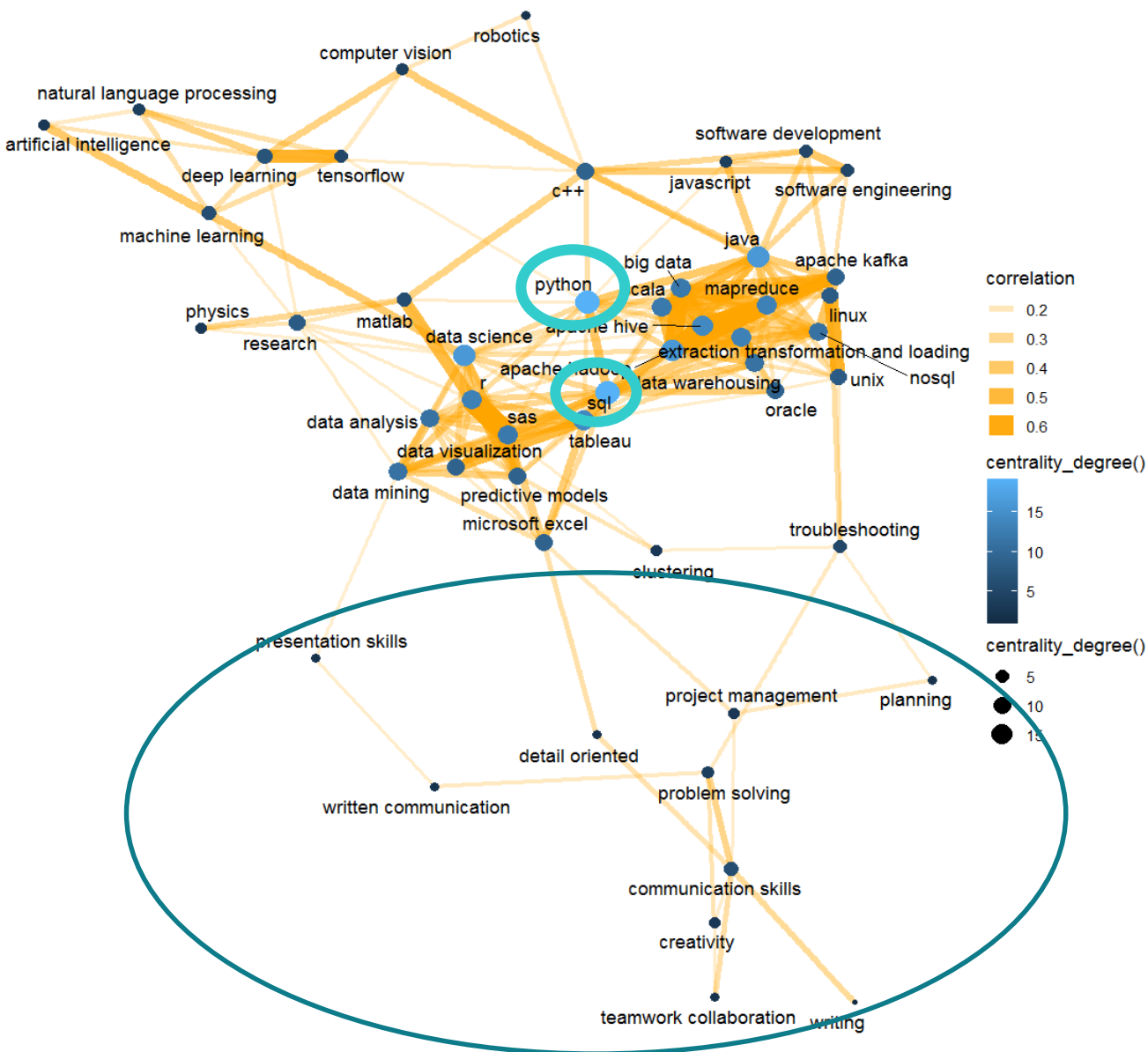


Source: Samek , Squicciarini and Cammeraat (forthcoming).
Authors' own compilation based on [BGT](#) data, 2020.



AI IS MORE THAN ONLY PROGRAMMING

WHAT ABOUT SOCIO-EMOTIONAL SKILLS?



TOP 50 SKILLS IN AI-RELATED JOBS , US

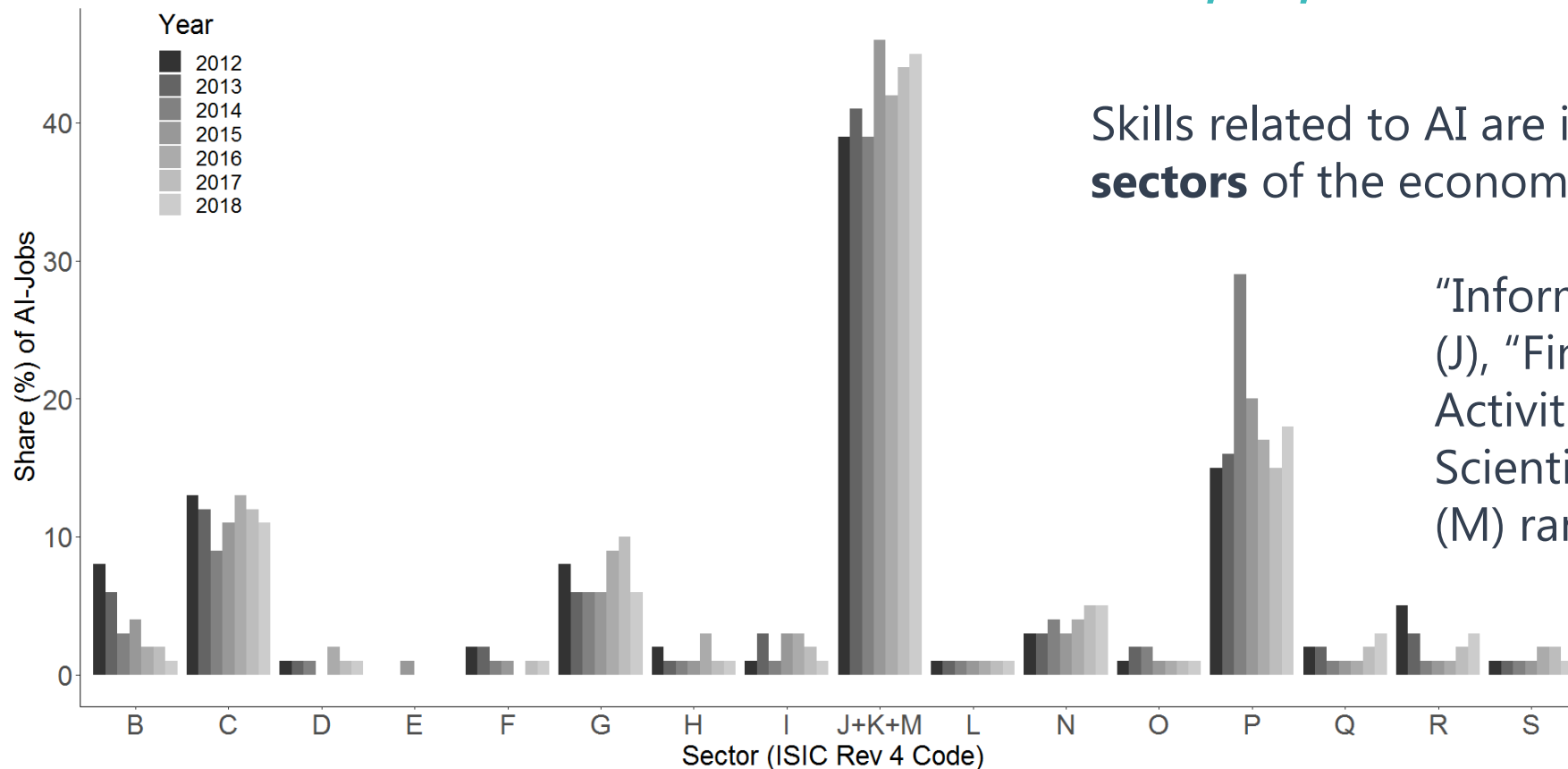
Network of skills, Corr>0.1, 2017-19

- Top 50 skills appearing in AI-related jobs tend to be rather “general”, and many of them relate to the “tools of the job”, i.e. are software-related (e.g. MATLAB, R, SAS, Java);
- This is also confirmed by Python and SQL being the most central nodes;
- A number of non-cognitive skills are also required in most AI-related jobs.



WHICH SECTORS REQUIRE AI-RELATED SKILLS?

AI-RELATED JOB ADS BY SECTOR, UK, 2012-18



Skills related to AI are in demand **across almost all sectors** of the economy, though to varying degrees.

“Information and Communication” (J), “Financial and Insurance Activities” (K) and “Professional, Scientific and Technical Activities” (M) rank at the top in terms of AI-job intensive sectors, in all countries considered.

B: Mining and Quarrying, C: Manufacturing, D: Electricity, Gas, Steam and Air-Conditioning Supply, E: Water Supply; Sewerage, Waste Management and Remediation Activities, F: Construction, G: Wholesale and Retail Trade, H: Transportation and Storage, I: Accommodation and Food Service Activities, J: Information and Communications, K: Financial and Insurance Activities, L: Real Estate Activities, M: Professional, Scientific and Technical Activities, N: Administrative and Support Service Activities, O: Public Administration and Defence, P: Education, Q: Health and Social Services, R: Arts, Entertainment and Recreation, S: Other Service Activities



WHICH OCCUPATIONS REQUIRE AI-RELATED SKILLS?

AI-RELATED JOBS, UK, BY ISCO 08 OCCUPATIONAL GROUP, 2012-2018

| ISCO | ISCO Name | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|------------------|--|-------|-------|-------|--------|--------|--------|--------|
| 1 | Managers | 112 | 92 | 124 | 359 | 417 | 1,118 | 1,317 |
| 2 | Professionals | 3,163 | 4,150 | 4,530 | 9,406 | 13,554 | 23,751 | 22,982 |
| 3 | Technicians and associated professionals | 251 | 358 | 361 | 657 | 1,068 | 1,987 | 2,221 |
| 4 | Clerical support workers | 33 | 33 | 61 | 65 | 139 | 146 | 151 |
| 5 | Service and sales workers | 25 | 30 | 45 | 67 | 158 | 311 | 324 |
| 6 | Skilled agricultural, forestry and fishery workers | 0 | 0 | 0 | 0 | 0 | 5 | 4 |
| 7 | Craft and related trade workers | 13 | 20 | 60 | 103 | 191 | 331 | 439 |
| 8 | Plant machine operators, and assemblers | 1 | 6 | 8 | 7 | 20 | 44 | 122 |
| 9 | Elementary occupations | 1 | 2 | 11 | 14 | 17 | 27 | 74 |
| Total (all jobs) | | 3,647 | 4,745 | 5,300 | 10,839 | 15,794 | 28,181 | 27,704 |

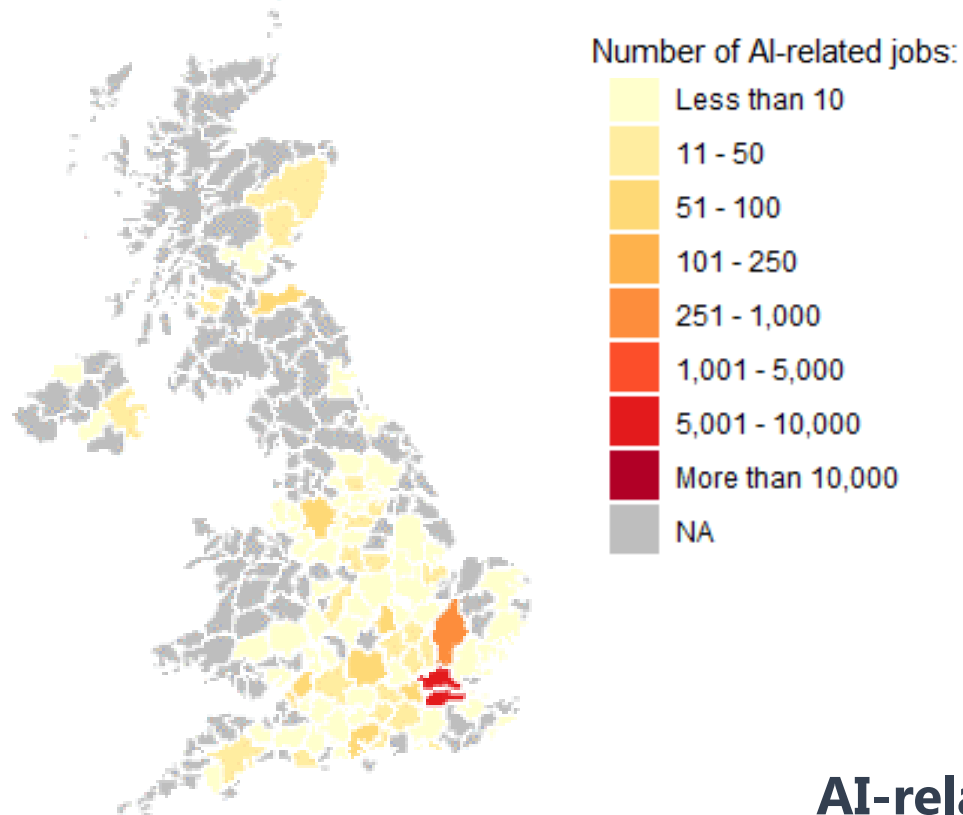
Note: No AI-related jobs are found in Armed Forces; not all AI-related jobs can be allocated and hence total does not necessarily equal sum of row values.

Source: Nachtigall and Squicciarini (forthcoming). Authors' own compilation based on [BGT](#) data.



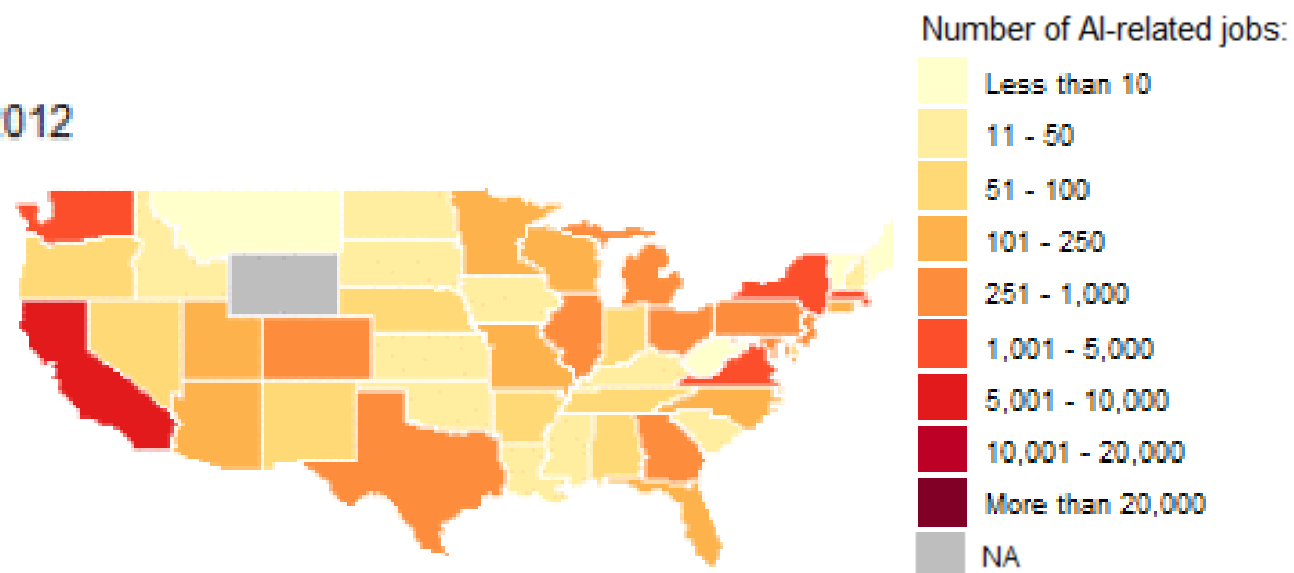
WHERE IS AI-TALENT HIRED?

UNITED KINGDOM



UNITED STATES

2012

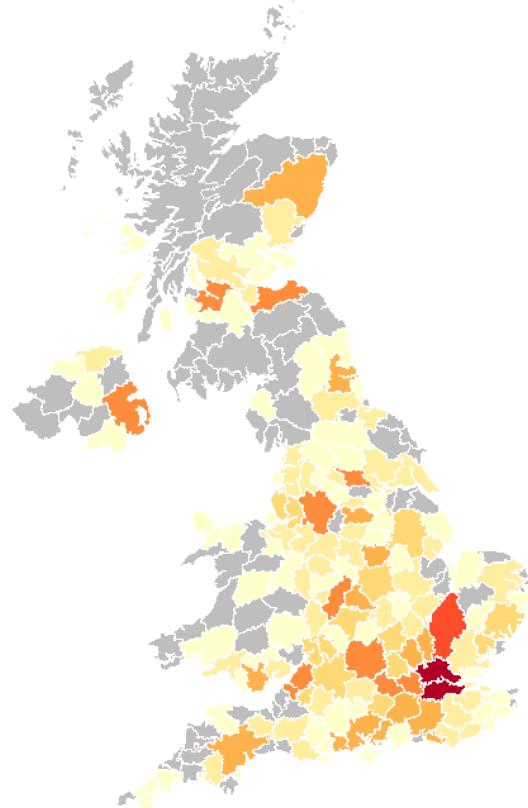


AI-related jobs are mainly **clustered in** relatively **few areas**.
Over time, new clusters are emerging and existing clusters are **growing**.

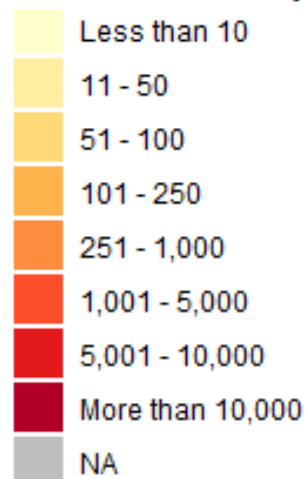


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UNITED KINGDOM

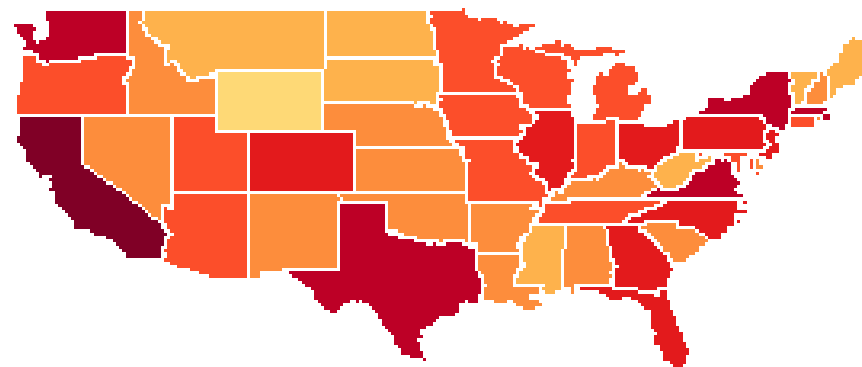


Number of AI-related jobs:

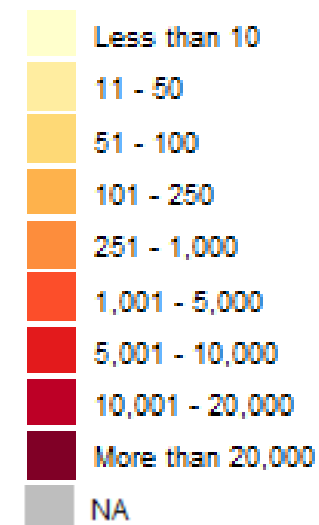


UNITED STATES

2019



Number of AI-related jobs:



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1 – 5 February 2021

QUESTIONS FOR DISCUSSION



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THE **DEMAND FOR AI SKILLS AND JOBS** HAS INCREASED OVER TIME.

JOBS REQUIRING AI-RELATED SKILLS CAN BE FOUND **IN ALL OCCUPATIONAL CATEGORIES**. **COGNITIVE** AS WELL AS **SOCIO-EMOTIONAL SKILLS ARE KEY** FOR AI-RELATED WORKERS.

SOME “HOW TO” QUESTIONS IN NEED OF AN ANSWER:

- HOW TO SUBDIVIDE CORE FROM NON-CORE SKILLS, TO INFORM EDUCATION AND TRAINING POLICIES?
- HOW TO BEST MATCH INDUSTRY NEEDS AND HUMAN CAPITAL AVAILABILITY WHEN IT COMES TO AI?
- FAMILIARITY FOSTERS ACCEPTANCE. HOW TO HELP PEOPLE FAMILIARISE WITH AI AND GET THE SKILLS TO WORK WITH AI?
- HOW TO FOSTER TRUST IN AI AND USE IT IN A SOCIETALLY AND ECONOMICALLY ENHANCING FASHION? WHICH ROLE DO SKILLS PLAY IN THIS RESPECT?
- DIETMAR HARHOFF (MPI), IN HIS INTERVENTION, ADVOCATED THAT A SHARE OF THE POPULATION BE TRAINED IN AI (AS IN FINLAND). HOW TO BEST DO SO?