TECHNICAL NOTE

AI Data Partnerships - LinkedIn Methodology

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Overview

In this note we outline the methodologies used to define AI Talent on LinkedIn and several LinkedIn metrics developed to understand and monitor AI workforce trends, including: Top AI Skills, Fastest Growing AI Skills, AI Talent Concentration, the Relative AI Talent Hiring Rate, Relative AI Penetration, Female Representation with AI Talent, AI Talent Migration, and Career Transitions into AI jobs.

Dimensions

LinkedIn Data

This body of work represents the world seen through LinkedIn data, drawn from the anonymized and aggregated profile information of LinkedIn's 1+ billion members around the world. As such, it is influenced by how members choose to use the platform, which can vary based on professional, social, and regional culture, as well as overall site availability and accessibility. In publishing these insights from LinkedIn's Economic Graph, we want to provide accurate statistics while ensuring our members' privacy. As a result, all data show aggregated information for the corresponding period following strict data quality thresholds that prevent disclosing any information about specific individuals.

Country Sample

We provide data on Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Costa Rica, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Saudi Arabia, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Türkiye, United Arab Emirates, United Kingdom, United States, and Uruguay.

Skills

LinkedIn members self-report their skills on their LinkedIn profiles. Currently, more than 41,000 distinct, standardized skills are identified by LinkedIn.

LinkedIn categorizes AI skills into 2 mutually exclusive groups: “AI Engineering” and “AI Literacy” skills, where, broadly, AI Engineering skills refer to the technical expertise and practical competencies required to design, develop, deploy, and maintain artificial intelligence systems, and AI Literacy skills refer to the knowledge, abilities, and critical thinking competencies needed to understand, evaluate, and effectively interact with

artificial intelligence technologies. As skills are ever evolving, we maintain and refresh these classifications on a periodic basis. For a list of skills included in this analysis, please see our AI Skills List below.

Industry

Our industry taxonomy is a collection of entities that share economic activities and contribute to a specific product or service. An industry represents the products or services that a company offers or sells. We analyze the following industries in the context of AI: Education; Financial Services; Manufacturing; Professional Services; and Technology, Information and Media.

Gender

We recognize that some LinkedIn members identify beyond the traditional gender constructs of "man" and "woman." If not explicitly self-identified, we have inferred the gender of members included in this analysis either by the pronouns used on their LinkedIn profiles or inferred on the basis of first name. Members whose gender could not be inferred as either man or woman were excluded from any gender analysis. Please note that we filter out countries where our gender attribution algorithm does not have sufficient coverage.

AI Jobs or Occupations

LinkedIn member titles are standardized and grouped into over 16,000 occupations. These are not sector or country specific. An AI job is an occupation that requires AI skills to perform the job. Examples of such occupations include (but are not limited to): Machine Learning Engineer, Artificial Intelligence Specialist, Data Scientist, Computer Vision Engineer etc.

AI Talent

A LinkedIn member is considered AI talent if they have explicitly added at least two AI skills to their profile and/or they are or have been employed in an AI job.

Methodologies

1. Top AI Skills

These are the AI skills most frequently added by all members from 2015 onwards.

Interpretation: *The most added AI Engineering skills globally are Machine Learning, AI, and*

Deep Learning.

2. Fastest Growing AI Skills

The Year-over-Year (YoY) growth rate for AI skills most frequently added by all members. Please note that we implement thresholds to skill add volumes in the most recent year, which are set at the 50th percentile of the most recent year's AI skill adds distribution by country.

Interpretation: *The fastest growing AI Engineering skills globally are Custom GPTs, AI Productivity, and AI Agents.*

3. AI Talent Concentration

The counts of AI talent are used to calculate talent concentration metrics, e.g., to calculate the country-level AI talent concentration, we use the counts of AI talent in a country divided by the counts of LinkedIn members in that respective country. Note that concentration metrics may be influenced by LinkedIn coverage in these countries and should be utilized with caution.

Interpretation: *AI Talent with AI Engineering skills represents 0.78% of LinkedIn members in the United States.*

4. Relative AI Talent Hiring Rate YoY Ratio

The LinkedIn hiring rate is a measure of hires normalized by LinkedIn membership. It is computed as the percentage of LinkedIn members who added a new employer in the same period the job began, divided by the total number of LinkedIn members in the corresponding location.

The AI hiring rate is computed utilizing the overall hiring rate methodology, but only considering members classified as AI talent. The relative AI talent hiring rate YoY ratio is the year-over-year change in the AI hiring rate relative to the overall hiring rate in the same country. We share a 12-month moving average.

Interpretation: *In the United States, the ratio of AI talent hiring relative to overall hiring has grown 24.7% year-over-year.*

5. Skills Penetration

Skills Genome

For any entity (occupation, country, industry, etc.), the skills genome is an ordered list (a vector) of the 50 most characteristic skills of that entity. These most characteristic skills are determined using a TF-IDF algorithm, which down-ranks ubiquitous skills that add little information about that specific entity (e.g. Microsoft Word) and up-ranks skills unique to that specific entity (e.g., Artificial Intelligence). Further details are available at LinkedIn's Skills Genome and our LinkedIn-World Bank Methodology note.

As an example, Table 1 details the Skills Genome of the Technology, Information and Media industry in the United States in 2024, displaying the top 20 skills ranked by TF-IDF.

Skill Name	TF-IDF Skill Rank
Amazon Web Services (AWS)	1
Software as a Service (SaaS)	2
Artificial Intelligence (AI)	3
Python (Programming Language)	4
Go-to-Market Strategy	5
Customer Success	6
Large Language Models (LLM)	7
Salesforce.com	8
SQL	9
Generative AI	10

AI Skills Penetration

The aim of this indicator is to measure the intensity of AI skills in a given entity through the following methodology:

- We compute frequencies for all self-added skills by LinkedIn members in a given entity (occupation, industry, etc.) from 2015 onwards.
- We re-weight skill frequencies using a TF-IDF model to get the top 50 most representative skills in that entity. These 50 skills compose the "skill genome" of that entity.

- We compute the share of skills that belong to the AI skill group out of the top skills in the selected entity.

Interpretation: *The AI skill penetration rate signals the prevalence of AI skills across occupations, or the intensity with which LinkedIn members utilize AI skills in their jobs. For example, the top 50 skills for the occupation of engineer are calculated based on the weighted frequency with which they appear in LinkedIn members' profiles. If four of the skills that engineers possess belong to the AI skill group, this measure indicates that the penetration of AI skills is estimated to be 8% among engineers (e.g., 4/50).*

Relative AI Skills Penetration

To allow for skills penetration comparisons across countries, the skills genomes are calculated, and a relevant benchmark is selected (e.g., a global average). A ratio is then constructed between a country and the benchmark's AI skills penetrations, controlling for occupations.

Interpretation: *A country's relative AI skills penetration of 1.5 indicates that AI skills are 1.5 times as frequent as in the benchmark, for an overlapping set of occupations.*

Global Comparison

For cross-country comparison, we present the relative penetration rate of AI skills, measured as the sum of the penetration of each AI skill across occupations in a given country, divided by the average global penetration of AI skills across the overlapping occupations in a sample of countries.

Interpretation: *A relative penetration rate of 2 means that the average penetration of AI skills in that country is two times the global average across the same set of occupations.*

Global Comparison: By Industry

The relative AI skills penetration by country for a given industry provides an in-depth sectoral decomposition of AI skill penetration across industries and countries.

Interpretation: *A country's relative AI skill penetration rate of 2 in the education sector means that the average penetration of AI skills in that country is two times the global average across the same set of occupations in that sector.*

Global Comparison: By Gender

The relative AI skills penetration by gender provides a cross-country comparison of AI skill penetrations within a gender. Since the global averages are distinct for each gender, this metric should only be used to compare country rankings within each gender, not for cross-gender comparisons within countries.

Interpretation: *A country's AI skills penetration for women of 1.5 means that members who are women in that country are 1.5x more likely to list AI skills than the average female member in all countries pooled together across the same set of occupations that exist in the country-gender combination.*

Global Comparison: Across Genders

The relative AI skills penetration across genders allows for cross-gender comparisons within and across countries globally, since we compare a country's AI skill penetration by gender to the same global average regardless of gender.

6. Female representation in AI

The share of AI talent that are women.

Interpretation: *Female representation within AI Talent with AI Engineering skills is 30.5% globally.*

7. AI Talent migration

Data on migration comes from the World Bank Group – LinkedIn "Digital Data for Development" partnership (please see https://linkedindata.worldbank.org/ and Zhu et al. [2018]). LinkedIn migration rates are derived from the self-identified locations of LinkedIn member profiles. For example, when a LinkedIn member updates their location from Paris to London, this is counted as a migration. Migration data is available from 2019 onwards.

LinkedIn data provide insights to countries on the AI Talent gained or lost due to migration trends. AI Talent migration is considered for all members with AI Skills/holding AI jobs at time *t* for country *A* as the country of interest and country *B* as the source of inflows and destination for outflows. Thus, net AI Talent migration between country A with respect to country B is calculated as:

$$\text{Net AI Talent Migration}_{a,b,t} = \text{Net AI Talent flows}_{a,b,t} \;/\; \text{Member count}_{a,t}$$

Net flows are defined as total arrivals minus departures within a given time period. LinkedIn membership varies between countries, which can prove challenging when interpreting absolute movements of members from one country to another. Migration flows are therefore normalised with respect to each country. For example, for country A, all absolute net flows into and out of country A, regardless of origin and destination countries, are normalised based on the LinkedIn membership of country A at the end of each year and multiplied by 10,000. Hence, this metric indicates relative talent migration from all countries to and from country A. Please note that minimum thresholds have been applied such that transitions have a sufficient sample size.

Interpretation: *The United States had a positive net flow of AI Talent relative to its membership size at 1.07 net flow per 10k members.*

8. Career Transitions into AI jobs

We consider the source occupations that feed AI occupations, analyzing the share of transitions into AI occupations pooled over a five-year period. Career transitions are computed by aggregating member-level job transitions from one occupation to another occupation that the member has previously not held. We exclude first occupations added by new graduates and intra-occupation transitions.

Interpretation: *In the United States, 26.9% of transitions into AI Engineer came from Software Engineers, followed by 13.3% from Data Scientists.*

The LinkedIn AI Skills List

AI Engineering

- Artificial Intelligence (AI)
- Image Processing
- Machine Learning
- Classification
- Computer Vision
- Neural Networks
- Speech Recognition

- Semantic Web
- Parsing
- Pattern Recognition
- Natural Language Processing (NLP)
- Predictive Modeling
- Ontologies
- Expert Systems
- Text Mining
- Knowledge Representation and Reasoning
- Computational Linguistics
- Information Extraction
- Fuzzy Logic
- Machine Translation
- Decision Trees
- Support Vector Machine (SVM)
- OpenCV
- Computational Geometry
- Knowledge Discovery
- Weka
- Recommender Systems
- Web Mining
- Artificial Neural Networks
- Facial Recognition
- Text Analytics
- Computational Intelligence
- Semantic Technologies
- Evolutionary Algorithms
- Reinforcement Learning
- Object Recognition
- 3D Reconstruction
- Text Classification
- Statistical Inference
- Sentiment Analysis
- Natural Language Understanding
- Intelligent Agents
- Automated Reasoning

- Algorithm Analysis
- RapidMiner
- Question Answering
- NLTK
- WordNet
- Natural Language Generation
- Feature Extraction
- Feature Selection
- Gesture Recognition
- Association Rules
- Unsupervised Learning
- Algorithm Development
- Deep Learning
- Scikit-Learn
- TensorFlow
- Keras
- Theano
- Caffe
- PyTorch
- Microsoft Azure Machine Learning
- Cognitive Computing
- Convolutional Neural Networks (CNN)
- Random Forest
- Supervised Learning
- Chatbot Development
- Deep Neural Networks (DNN)
- Recurrent Neural Networks (RNN)
- k-means clustering
- Applied Machine Learning
- Machine Learning Algorithms
- Automated Machine Learning (AutoML)
- Chatbots
- Generative Adversarial Networks (GANs)
- Google Cloud AutoML
- MLOps
- Apache Spark ML

- Generative AI
- StyleGAN
- Transformer Models
- Responsible AI
- Deep Convolutional Generative Adversarial Networks (DCGAN)
- Conditional Generation
- Image-to-Image Translation
- Hyperparameter Tuning
- Generative Design Optimization
- Probabilistic Programming
- Graph Embeddings
- Time Series Forecasting
- Autoencoders
- Image Inpainting
- Generative Synthesis
- Audio Synthesis
- Text-to-Image Generation
- Variational Autoencoders (VAEs)
- Style Transfer
- Variational Autoencoders
- Generative Modeling
- Model Interpretation
- Graph Networks
- Video Generation
- Hyperparameter Optimization
- Generative Pre-Training
- Conditional Image Generation
- Generative Flow Models
- Model Compression
- Neural Network Architecture Design
- Image Generation
- Synthetic Data Generation
- Text Generation
- Automated Feature Engineering
- Probabilistic Generative Models
- Automated Clustering

- Concept Drift Adaptation
- Image Synthesis
- Meta-learning
- Model Training
- Autoregressive Models
- Music Generation
- Generative Optimization
- Generative Adversarial Imitation Learning
- Generative Replay Memory
- Generative Neural Networks
- Generative Query Networks (GQNs)
- Large Language Models (LLM)
- Amazon Bedrock
- LangChain
- Large Language Model Operations (LLMOps)
- Custom GPTs
- OpenAI API
- AI Productivity
- Prompt Flow
- AI Strategy
- Azure AI Studio
- Spring AI
- AI Agents

AI Literacy

- Generative Art
- Generative AI
- ChatGPT
- DALL-E
- GPT-3
- Stable Diffusion
- Prompt Engineering
- GPT-4
- Midjourney
- GitHub Copilot
- Google Bard

- Microsoft Copilot Studio
- Microsoft Copilot
- Generative AI Tools
- AI Prompting
- Generative AI Studio
- Anthropic Claude
- AI Builder
- Multimodal Prompting
- Google Gemini
- LLaMA

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