Labor Market Analysis for:
0707.00 Computer Software Development (Machine Learning & Artificial intelligence Skills)

Inland Empire/Desert Center of Excellence, April 2025

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Summary

Program LMI Endorsement	All LMI Criteria Met	**Some LMI Criteria Met (Proceed with Caution)**	LMI Criteria NOT Met
	☐	✓	☐

Program LMI Endorsement Criteria		
Supply Gap	**Yes** ✓	No ☐
	Comments: There is *projected* to be **120 annual job openings** throughout the Inland Empire/Desert region, which is more than the **7 annual average awards conferred by educational institutions over the last 3 years** (see Exhibit 1b)**.** Supply data includes both community college awards (0) and non-community college awards (7).	
Living Wage	**Yes** ✓	No ☐
	Comments: **All occupations** have entry-level hourly wages $13-$40 **above the estimated IE/D living wage** of 20.42.[1]	
Education	Yes ☐	**No** ✓
	Comments: The typical entry-level education for these six occupations is a **bachelor's degree**, and **less than 33% of all workers in the field (15%)** have completed some college or an associate degree as their highest level of education. See Exhibit 9 for more details.	

The Inland Empire/ Desert (IE/D) Center of Excellence for Labor Market Research (IE/D COE) reviewed the following occupations to prepare this report:

- Above Middle-Skill (typically require a bachelor's degree or above)
  - Computer and Information Systems Managers (11-3021)
  - Database Administrators (15-1242)
  - Database Architects (15-1243)
  - Software Developers (15-1252)
  - Software Quality Assurance Analysts and Testers (15-1253)
  - Data Scientists (15-2051)

Summary of findings

Demand

- The number of jobs related to the assessed occupations is projected to increase 14% through 2028, with 120 annual job openings (new and replacement jobs).
- Hourly entry-level wages for all occupations are above living wage at the 25th percentile hourly wage ranging from $33.36 to $60.84 in IE/D.
- There were 316 online job postings from 97 employers over the past 12 months with the highest postings for software developers and data scientists.
- Most job postings for target occupations require a bachelor's degree (72%), followed by an associate degree (21%), above a bachelor's degree (5%), and a high school diploma or equivalent (2%).

Supply

- On average, there were 7 annual awards conferred by educational institutions over the last 3 years in related fields: 0 from community colleges and 7 from other institutions (e.g., 4-year universities, private schools).
- IE/D community college students that exited these programs in the 2022-23 academic year earned a median annual wage of $28,960 ($13.92 per hour).
- 48% of California students that exited their program in 2022-23 reported that they are now earning a living wage.

[1] *The UW self-sufficiency standard is currently used by the CO and other COEs, the self-sufficiency standard was last updated by UW in 2024. To provide an alternative perspective, the COE will provide an alternative living wage calculation from MIT in the analysis below as an additional reference point. MIT estimates, the living wage for an adult with no kids living in 2024 is $26.30 in Riverside County and $25.17 in San Bernadino County.*

Introduction

California Community College Computer Software Development (TOP 0707.00) programs prepare students for employment in the design and development of computer-based applications. Includes systems analysis, design, specification, programming, database analysis and design, user interface development, maintenance, and testing (Taxonomy of Programs, 2023). The knowledge, skills, and abilities trained by Computer Software Development programs lead to employment in occupations related to machine learning and artificial intelligence (AI).

Special Note: The purpose of this report is to measure the labor market in the Inland Empire-Desert region for workers with skills and training related to machine learning/AI development in the computer software development field. The occupations included in this grouping would include positions unrelated to this specific field if left unadjusted. Therefore, to appropriately adjust the occupational estimates, this report is using the following methodology:

- Regional job posting data for all occupations listed above was generated for the past 12 months, unfiltered, with total unique job postings equal to **2,226**.
- Regional job posting data for all occupations listed above was generated for the past 12 months, filtered to only include postings which include at least one of a curated list of specialized skills, with total unique job postings equal to **316**.
- The specialized skills include:
    - Machine Learning
    - Artificial Intelligence
    - Machine Learning Algorithms
    - Natural Language Processing (NLP)
    - Predictive Analytics
- Using the two totals, it appears that in the past 12 months 316 out of 2,226 unique job postings (**14%**) required or preferred machine learning/AI skills.
- This report will use that 14% ratio to estimate occupational demand for the listed occupations with the intended skills and training.
- Finally, analysis displayed from job posting data will be generated using the filtered dataset of 316 unique postings associated with the above curated list of specialized skills.

Job Demand

In 2023, there were 9,612 jobs in occupations related to machine learning/AI in the IE/D region. Regional employment for this occupation group is projected to increase by 14% through 2028 with 854 job openings projected annually. Exhibit 1a displays the unadjusted job count, five-year projected job growth, and job openings in the region.

Exhibit 1a. Unadjusted Five-year projections for occupations related to machine learning/AI, IE/D Region, 2023-2028

Occupation	SOC	2023 Jobs	2028 Jobs	2023 - 2028 % Change	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)
Computer and Information Systems Managers	11-3021	2,673	2,964	11%	1,182	236
Database Administrators	15-1242	439	473	8%	164	33
Database Architects	15-1243	154	179	16%	72	14
Software Developers	15-1252	4,530	5,275	16%	2,020	404
Software Quality Assurance Analysts and Testers	15-1253	995	1,087	9%	408	82
Data Scientists	15-2051	821	983	20%	423	85
Total		**9,612**	**10,961**	**14%**	**4,269**	**854**

SOURCE: LIGHTCAST 2025.1

However, when the 14% adjustment is made the above figures are revised downwards. Now, in 2023, there were 1,345 jobs in occupations related to machine learning/AI in the IE/D region. Regional employment for this occupation group is projected to increase by 14% through 2028 with 120 job openings projected annually. Exhibit 1b displays the adjusted job count, five-year projected job growth, and job openings in the region.

Exhibit 1b. Adjusted Five-year projections for occupations related to machine learning/AI, IE/D Region, 2023-2028

Occupation	SOC	2023 Jobs	2028 Jobs	2023 - 2028 % Change	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)
Computer and Information Systems Managers	11-3021	374	415	11%	165	33
Database Administrators	15-1242	61	66	8%	23	5
Database Architects	15-1243	22	25	16%	10	2
Software Developers	15-1252	634	739	16%	283	57
Software Quality Assurance Analysts and Testers	15-1253	139	152	9%	57	11
Data Scientists	15-2051	115	138	20%	59	12
Total		**1,345**	**1,535**	**14%**	**598**	**120**

SOURCE: LIGHTCAST 2025.1

Job Postings

The following analysis for occupations related to machine learning/AI using online job posting data.

Important note: The data produced in this section were generated by leveraging online job posting data sourced from Lightcast, which is the labor market analytics software tool COEs use to produce these briefs. The job posting data is collected from scraping online job boards such as LinkedIn, Indeed, Glassdoor and many others. The process Lightcast uses to assemble this data does have some limitations due to methods that recruitment professionals sometimes use (e.g., posting one job to fill multiple positions). For example, the number of jobs posted is not necessarily the same as the number of job vacancies.[2] While not perfect, Lightcast leverages machine learning/AI and other AI technologies to enrich, deduplicate and aggregate this information to make it a meaningful dataset.

Exhibit 2 displays the number of job ads posted for occupations related to machine learning/AI over the last 12 months and the median posting duration. Over the previous 12 months, there were 316 unique job postings for occupations related to machine learning/AI in the region from 97 employers.

Exhibit 2. Job ads and posting duration, IE/D Region, April 2024 – March 2025

Job Title	Job Ads	Median Posting Duration
Software Developers	227	26 days
Data Scientists	63	16 days
Database Administrators	11	27 days
Database Architects	7	25 days
Software Quality Assurance Analysts and Testers	5	24 days
Computer and Information Systems Managers	3	
Total	**316**	

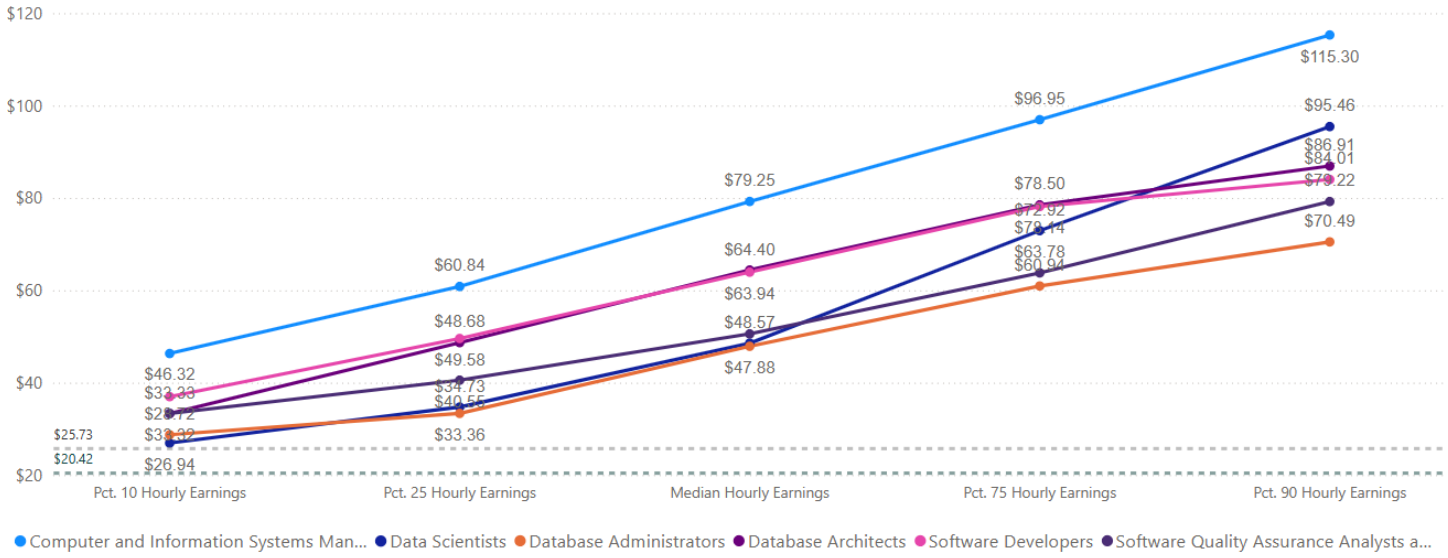
SOURCE: LIGHTCAST 2025.1

[2] *"Job Posting Analytics (JPA) Methodology." Lightcast Knowledge Base, https://kb.lightcast.io/en/articles/6957446-job-posting-analytics-jpa-methodology*

Earnings

Exhibit 3 displays the hourly earnings for occupations related to machine learning/AI compared to both the UW Self-Sufficiency Standard for the IE/D of $20.42[3] and the MIT IE/D living wage of $25.73.[4]

Exhibit 3. Projected hourly earnings by percentile, IE/D Region, 2023



Description	Pct. 10 Hourly Earnings	Pct. 25 Hourly Earnings	Median Hourly Earnings	Pct. 75 Hourly Earnings	Pct. 90 Hourly Earnings
Database Administrators	$28.72	$33.36	$47.88	$60.94	$70.49
Software Quality Assurance Analysts and Testers	$33.33	$40.55	$50.57	$63.78	$79.22
Data Scientists	$26.94	$34.73	$48.57	$72.92	$95.46
Database Architects	$33.32	$48.68	$64.40	$78.50	$86.91
Software Developers	$36.98	$49.58	$63.94	$78.14	$84.01
Computer and Information Systems Managers	$46.32	$60.84	$79.25	$96.95	$115.30

SOURCE: 2025.1

All projected entry-level earnings (that is, the earnings of the lowest paid 25% of employees in the IE/D) were above the UW Self-Sufficiency Standard for the IE/D (see Exhibit 3). The occupations were also above the MIT living wage for an adult with no children ($25.73) in projected entry-level earnings (see Exhibit 3).

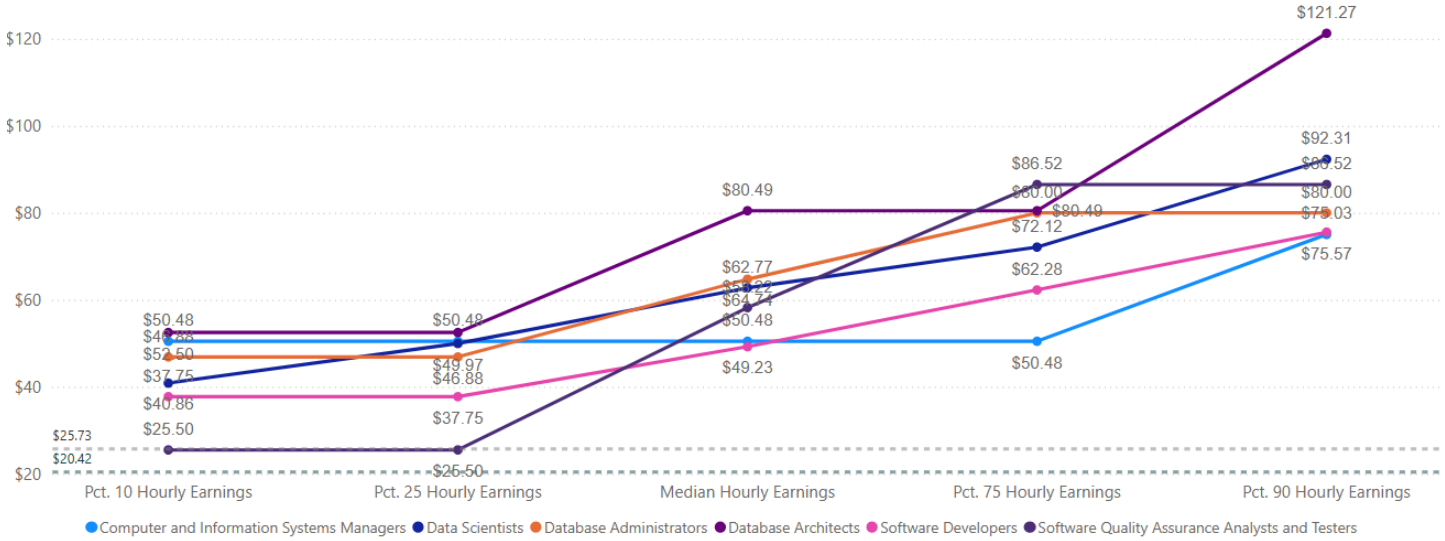
[3] *The UW self-sufficiency standard is currently used by the CO and other COEs, the self-sufficiency standard was last updated by UW in 2024. To provide an alternative perspective, the COE will provide an alternative living wage calculation from MIT in the analysis below as an additional reference point. MIT estimates, the living wage for an adult with no kids living in 2024 is $26.30 in Riverside County and $25.17 in San Bernadino County.*

[4] *ibid.*

Advertised Salary from Online Job Ads

Exhibit 4 displays the regional online advertised salaries for the occupations related to machine learning/AI over the last 12 months. The salary information of online job ad data suggests employers advertise entry level hourly wages between $25.50 and $50.48 (estimated to be equal to an annual salary between $53,040 and $104,998).

Exhibit 4. Hourly earnings of job postings by percentile, IE/D Region, April 2024 – March 2025



Description	Pct. 10 Hourly Earnings	Pct. 25 Hourly Earnings	Median Hourly Earnings	Pct. 75 Hourly Earnings	Pct. 90 Hourly Earnings
Computer and Information Systems Managers	$50.48	$50.48	$50.48	$50.48	$75.03
Data Scientists	$40.86	$49.97	$62.77	$72.12	$92.31
Database Administrators	$46.88	$46.88	$64.74	$80.00	$80.00
Database Architects	$52.50	$52.50	$80.49	$80.49	$121.27
Software Developers	$37.75	$37.75	$49.23	$62.28	$75.57
Software Quality Assurance Analysts and Testers	$25.50	$25.50	$58.22	$86.52	$86.52

SOURCE: LIGHTCAST 2025.1

Online Job Advertisements: top job titles, skills, education & work experience.

Exhibit 5 displays the job titles most frequently used in job postings for the occupations related to machine learning/AI over the last 12 months. Assessing the top advertised job titles may provide insight into the types of positions sought by employers.

Exhibit 5. Job titles most frequently used in job ads, IE/D Region, April 2024 – March 2025

Job Title	Unique Postings
AI Trainers	37
Software Engineers	19
Data Scientists	15
C++ Software Developers	14
Solution Experts	11
GIS Software Engineers	9
Python Software Engineers	9
Data Science Managers	6
Speakers/Writers	6
Solutions Architects	5

SOURCE: LIGHTCAST 2025.1

Exhibit 6 displays the employers posting the most job ads for this occupational group during the last 12 months. Showing employer names can provide insight into where students may find employment after completing a program and may inform job development and other employer engagement targets for faculty and staff involved in related programs. Esri and Monster Beverage had the highest unique job posts for this occupational group in the last 12 months. Posting intensity is the ratio of total job posts to unique job posts which are deduplicated. A higher posting intensity can represent the level of effort and activity the organization is putting into hiring for that position. The following report comes directly from Lightcast's Job Posting Analytics dashboard.

Exhibit 6. Employers posting the most job ads, IE/D Region, April 2024 – March 2025

Company	Total/Unique (Apr 2024 - Mar 2025)	Posting Intensity	Median Posting Duration
Esri	184 / 53	3 : 1	21 days
Monster Beverage	17 / 10	2 : 1	36 days
Anywhere Real Estate	13 / 8	2 : 1	26 days
Canonical Group	10 / 6	2 : 1	16 days
CACI International	20 / 5	4 : 1	33 days
Everguard.ai	4 / 4	1 : 1	10 days
Coral	8 / 4	2 : 1	35 days
Cleo Consulting	4 / 4	1 : 1	9 days
Yaamava' Resort & Casino At San Manuel	14 / 3	5 : 1	25 days
Launch Potato	3 / 3	1 : 1	n/a

SOURCE: LIGHTCAST 2025.1

Exhibit 7 displays the top common, specialized and computer skills that were included in the job postings over the last 12 months. Today's demand is an important indicator of which skills employers are looking for in the current market. Analyzing skills from a historical perspective as well as projecting the future needs of employers may provide insight into how the job posting skills demand compares to the market as a whole. Rapidly growing skills are those that are increasing in demand at a faster rate than the market as a whole. [5]

Exhibit 7. Top 10 in-demand skills from employer job ads, IE/D Region, April 2024 – March 2025

Common skills	Total Postings	Skill Growth Relative to Market
Communication	169	Lagging
Problem Solving	144	Growing
English Language	87	Growing
Mathematics	75	Rapidly Growing
Writing	75	Growing
Innovation	68	Rapidly Growing
Leadership	57	Stable
Operations	57	Stable
Grammar	50	Growing
Packaging And Labeling	49	Growing

[5] *"What are Lightcast Skill Projects", Lightcast Knowledge base, https://kb.lightcast.io/en/articles/8496296-what-are-lightcast-skill-projections*

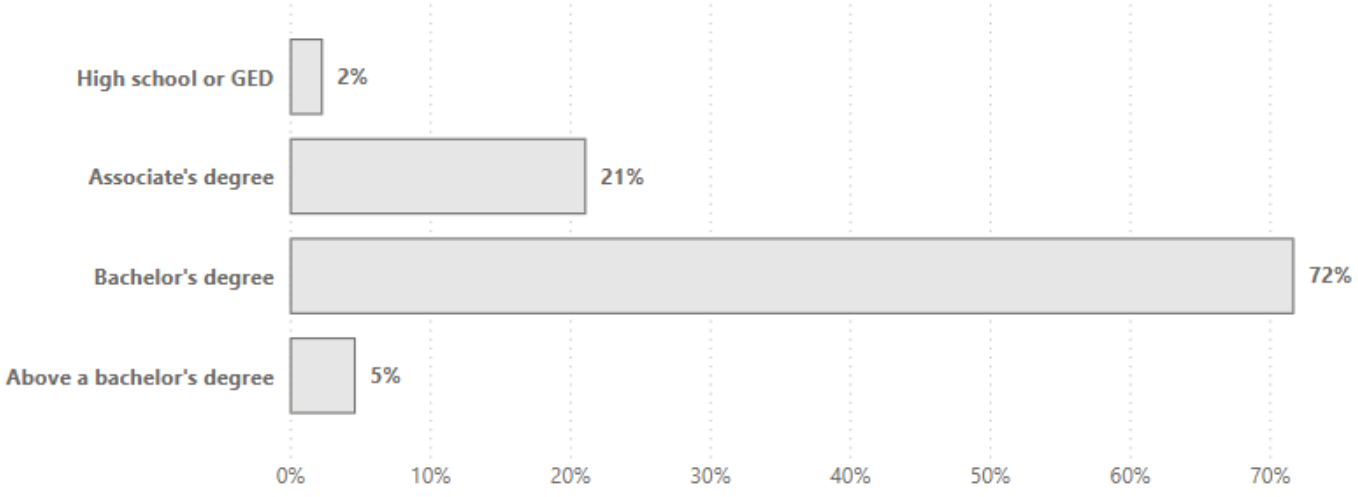
Specialized skills	Total Postings	Skill Growth Relative to Market
Machine Learning	234	Rapidly Growing
Artificial Intelligence	233	Growing
Computer Science	181	Rapidly Growing
Python (Programming Language)	171	Rapidly Growing
SQL (Programming Language)	112	Stable
Automation	98	Rapidly Growing
Amazon Web Services	87	Rapidly Growing
Data Science	84	Growing
Software Engineering	83	Rapidly Growing
Microsoft Azure	81	Rapidly Growing

Computer Skills	Total Postings	Skill Growth Relative to Market
Microsoft Excel	42	Growing
Microsoft Office	36	Growing
Microsoft Outlook	22	Rapidly Growing
Microsoft Word	21	Stable
Laboratory Information Management Systems	20	Growing
Microsoft PowerPoint	15	Rapidly Growing
Operating Systems	8	Rapidly Growing
SAP Applications	8	Rapidly Growing
Spreadsheets	6	Rapidly Growing
Microsoft Access	5	Lagging

SOURCE: LIGHTCAST 2025.1

Exhibit 8 includes the minimum educational requirements from job postings for this occupational group with bachelor's degree (72%) significantly greater than associate degree (21%) or above a bachelor's degree (5%) or high school diploma or equivalent (2%).

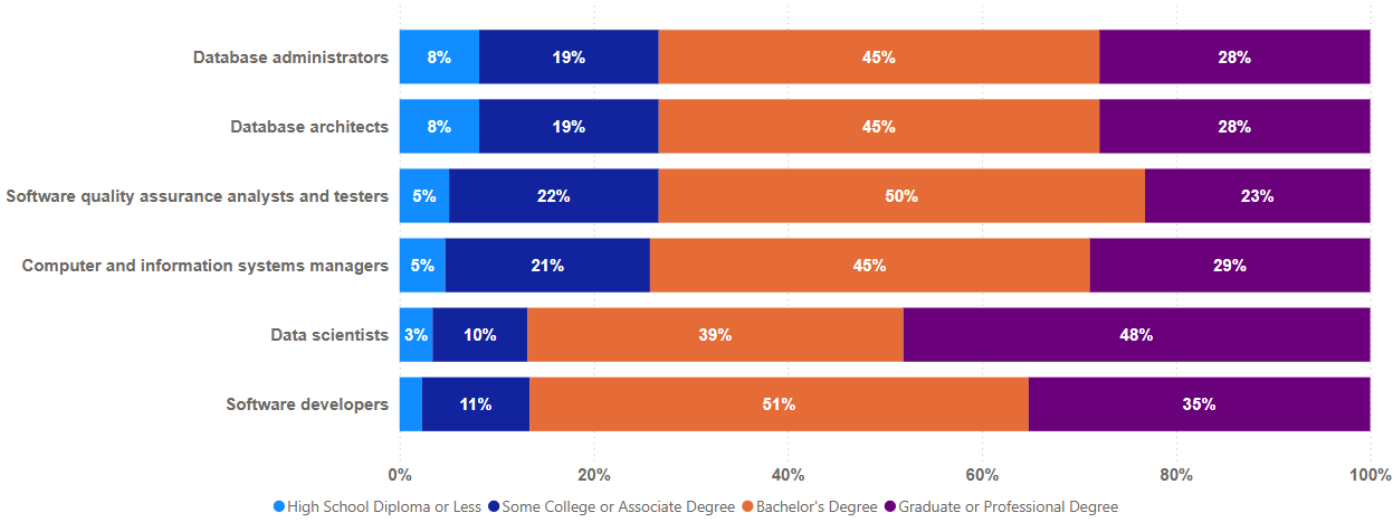
Exhibit 8 Minimum educational requirements in job postings for this occupational group, IE/D Region, April 2024 – March 2025



SOURCE: LIGHTCAST 2025.1

For the assessed occupations, the Bureau of Labor Statistics (BLS) education attainment data in Exhibit 9 for current professionals in the occupations of interest indicates that between 10% and 22% of workers have completed some college or an associate degree as their highest level of education.

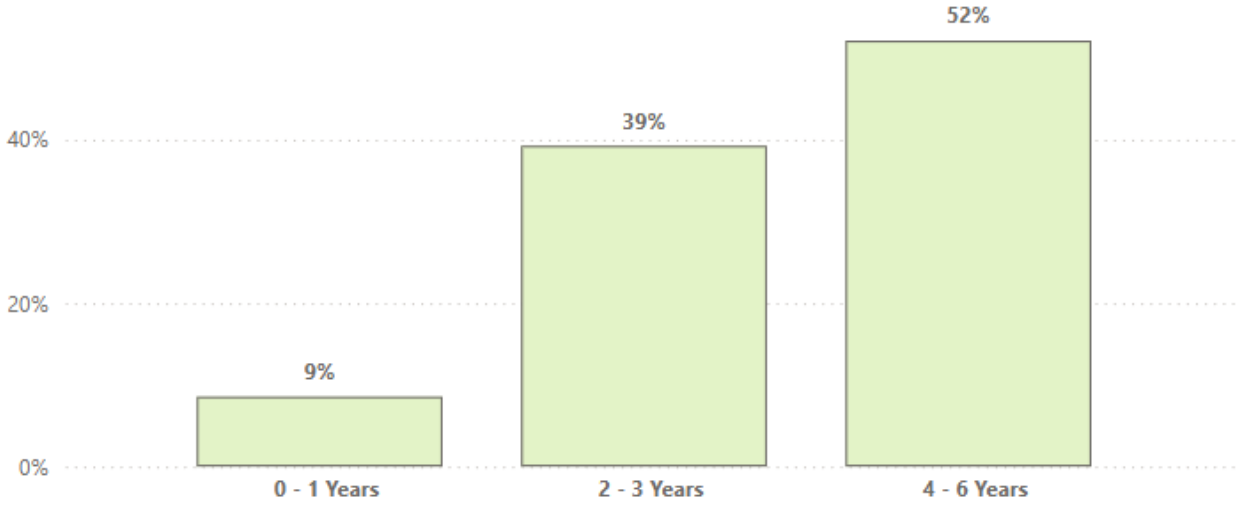
Exhibit 9 National-level Education Attainment for the Occupational Group



SOURCE: BLS 2021

Exhibit 10 displays the work experience typically required from employer job ads for this occupational group. The majority (52%) of employers listing minimum experience requirements sought candidates with 4-6 years of previous work experience.

Exhibit 10 Work experience requirements, IE/D Region, April 2024 – March 2025



SOURCE: LIGHTCAST 2025.1

Student Completions and Program Outcomes

No student completions for the Computer Software Development (TOP 0707.00) programs were found over the last three academic years (2020-2023). Based on the lack of data, it appears that in the previous three academic years, 0 regional community colleges issued an average of 0 awards in relevant programs.

Non-Community College Supply

Exhibit 11 displays award completion data available for these IE/D non-community college programs: Data Analytics, Other (CIP 30.7101); Computer Programming/Programmer, General (CIP 11.0201).

However, student award completion data was not found in the IE/D for other related non-community college programs: Data Science, General (CIP 30.7001); Computer Software Technology/Technician (CIP 15.1204); Artificial Intelligence (CIP 11.0102).

In the previous three academic years, two regional non-community college institutions issued an average of 7 awards in relevant programs.

Exhibit 11 Annual average non-community college awards for machine learning/AI programs, IE/D, 2019-2022

CIP	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
11.0201	Computer Programming/Programmer, General	University of Phoenix-California	9	2	2	4
30.7199	Data Analytics, Other	California Baptist University	1	1	7	3
Total			**10**	**3**	**9**	**7**

SOURCE: IPEDS

Strong Workforce Program Outcomes

California SWP program outcome data may provide useful insight into the likelihood of success for the proposed program. Community college student outcome information based on the selected TOP code and region is provided in Exhibit 12.

Exhibit 12 Computer Software Development strong workforce program outcomes, IE/D & California, 2022-23

Program Metric Title	Inland Empire	Statewide
Students	101	5,622
Earned 9+ Career Education Units	32%	25%
Completed Noncredit Workforce Preparation Milestone		67%
Earned an Award: Degree or Cert or Attained Appren. Journey Level Status		2%
Transferred to a Four-Year Institution: Four-Year Postsecondary Institution		8%
Median Annual Earnings	$28,690	$52,028
Median Change in Earnings		22%
Attained Living Wage		48%

SOURCE: LAUNCHBOARD

Appendix: Methodology

Exhibit 12 displays the average annual California Community College (CCC) awards conferred during the three academic years between 2020 and 2023 from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. Awards are the combined total during the timeframe, divided by three in this case to calculate an annual average. This is done to minimize the effect of atypical variations that might be present in a single year.

Community college student outcome information is from LaunchBoard and based on the selected TOP code and region. These metrics are based on records submitted to the California Community Colleges Chancellor's Office Management Information Systems (MIS) by community colleges, which come from self-reported student information from CCC Apply and the National Student Clearinghouse. Employment and earnings metrics are sourced from California's Employment Development Department's Unemployment Insurance database. When available, outcomes for completers are reported to demonstrate the impact that earning a degree or certificate can have on employment and earnings. For more information on the types of students included for each metric, please see the web link for LaunchBoard's Strong Workforce Program Metrics Data Element Dictionary in the References section (LaunchBoard, 2023a). Finally, employment in a job closely related to the field of study comes from self-reported student responses on the CTE Employment Outcomes Survey (CTEOS) administered by Santa Rosa Junior College (LaunchBoard, 2023a).

Appendix: References

Type of Data	Source
Occupational Projections, Wages, and Job Postings	Traditional labor market information data is sourced from Lightcast, a labor market analytics firm. Lightcast occupational employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment. https://lightcast.io/
Living Wage (UW)	Center for Women's Welfare, University of Washington. (2024). The self-sufficiency standard for California 2024. http://www.selfsufficiencystandard.org/. This calculation measures the income necessary for an individual of family to afford basic expenses. The data assesses the cost of housing, food, childcare, health care, transportation, and taxes. The living wage for one adult in San Bernardino County is $20.07 per hour ($42,392 annually). The living wage for one adult in Riverside County is $20.76 per hour ($43,854 annually). The average living wage to represent Inland Empire/Desert is $20.42 per hour ($43,123 annually).
Living Wage (MIT)	The living wage is derived from MITs Living Wage Calculator, which measures the income necessary for an individual of family to afford basic expenses. The data assesses the cost of housing, food, childcare, health care, transportation, and taxes. For more information, see: https://livingwage.mit.edu/pages/methodology The living wage for one adult in San Bernardino County is $25.17 per hour ($52,353.60 annually). The living wage for one adult in Riverside County is $26.30 per hour ($54,704 annually). The average living wage to represent Inland Empire/Desert is $25.74 per hour (53,539.20 annually)
Typical Education and Training Requirements, and Educational Attainment	The Bureau of Labor Statistics (BLS) provides information about education and training requirements for hundreds of occupations. BLS uses a system to assign categories for entry-level education, work experience in a related occupation, and typical on-the-job training to each occupation for which BLS publishes projections data. For more information, see https://www.bls.gov/emp/documentation/education/tech.htm
Educational Supply	The CCCCO Data Mart provides information about students, courses, student services, outcomes and faculty and staff. For more information, see: https://datamart.cccco.edu The National Center for Education Statistics (NCES) Integrated Postsecondary Integrated Data System (IPEDS) collects data on the number of postsecondary awards earned (completions). For more information, see https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions

Student Metrics and Demographics	LaunchBoard, a statewide data system supported by the California Community Colleges Chancellor's Office and hosted by Cal-PASS Plus, provides data on progress, success, employment, and earnings outcomes for California community college students. For more information, see: https://www.calpassplus.org/LaunchBoard/Home.aspx