

# Outcomes of Advertised Computer Science Faculty Searches for 2022

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## **Abstract**

This work directly follows previous work that analyzed current and future Computer Science needs via advertised tenure-track faculty searches for 2022. This follow-on work looks to understand the relative success of institutions in hiring the tenured/tenure-track faculty in the areas of Computer Science that were being sought. It is similar to a study of tenure-track faculty hiring outcomes last done in the pre-Covid impacted year of 2019.

Responses to a survey were obtained from 148 institutions that reported seeking tenure-track faculty in 2022. The summary results continue to show a mix of success with 21% of institutions reporting a failed search and just 55% of institutions hiring at least the number of faculty they were seeking. There was a clear difference this year for results between PhD and non-PhD institutions with PhD institutions having higher success and much lower failure rates. The new faculty being hired were most likely to start having just earned their PhD.

In terms of areas, AI/Data Mining/Machine Learning, Databases and Data Science collectively represent 35% of the positions filled. There continues to be stronger demand for positions in Security than PhD production or positions actually filled, although the differences are a bit less than were found in 2019.

# 1 Introduction

This work directly follows previous work analyzing current and future Computer Science needs via advertised tenure-track faculty searches for 2022 [2]. The work seeks to understand the relative success of institutions in hiring the tenured/tenure-track faculty in the areas that were being sought. This report also follows on from a similar study of tenure-track faculty hiring outcomes in 2019 [1]. An outcomes study was not done the past two years because of disruptions due to the Covid-19 pandemic.

The primary tool used for this work is a survey sent to the advertised search committee contact or head of the department (or related program). Survey results are analyzed and as appropriate, the analysis takes into account ads that were posted by each institution (and summarized in [2]) as well as pertinent results reported in the 2021 CRA Taulbee Survey of PhD-producing Computer Science departments [3]. The remainder of this report elaborates on the methodology used to obtain data and the results from analyzing it.

## 2 Methodology

A survey consisting of four numeric-answer questions and one open-text-response question was constructed using the Qualtrics survey tool, which created a survey that could be taken online. The four numeric questions asked about the number of faculty sought to hire, the number that were hired, the number of faculty hired in a list of areas and the previous positions of the faculty hired. The open-response question allowed respondents to provide any additional feedback. The survey instructions and questions are shown in Appendix A.

Invitations were emailed to 460 institutions (some with multiple search contacts) in September 2022. These institutions placed ads between August and December 2021 for tenure-track positions to begin in 2022. The previous report on hiring needs [2] was based on ads placed by 400 institutions prior to November 15, 2021, but ads for the dataset continued to be collected through calendar-year 2021. The email message sent to each search included a URL for them to use in participating. The URL contained the email address for each contact so that survey results could be linked to information from the ads for each institution.

## 3 Results

We obtained and used survey responses from 148 institutions (comparable to the 147 in the last study for 2019 hires) that reported seeking tenure-track faculty in 2022. Survey responses were dropped if the number of faculty positions being sought was zero or not specified. Two responses were dropped because they could not be matched with the responding institution. Multiple responses from the same institution were combined in cases that multiple searches from the institution led to multiple survey responses. 40 of the respondents provided written-text feedback as part of their response.

The remainder of this section reports results from analyzing the survey responses. As appropriate, the analysis take into account ads that were posted by each institution and summarized in [2] as well as pertinent results reported in the 2021 Taulbee Survey of PhD-producing Computer Science

departments [3]. Written-text feedback is included as appropriate.

### 3.1 Faculty Positions Being Sought

A summary of the faculty positions sought for the 148 institutions based on responses to the survey is shown in Table 1. Information from the ads dataset is used to classify each institution according to the highest Computer Science degree it offers. As done in [2], PhD-granting institutions are further classified into PhD100 and PhDMore using the U.S. News Rankings of the 100 Best Graduate schools<sup>1</sup>, for the top-100 U.S. and then more PhD institutions including those not in the U.S.

Table 1: Summary of Faculty Positions Sought by Highest Degree Offered

Highest Degree	Number of Institutions	Number of Positions Sought			Total Positions
		1	2	3+	
PhD100	44	3 (7%)	11 (25%)	30 (68%)	191
PhDMore	20	4 (20%)	5 (25%)	11 (55%)	67
MS	21	4 (19%)	13 (62%)	4 (19%)	43
BS/BA	63	49 (78%)	13 (21%)	1 (2%)	78
All	148	60 (41%)	42 (28%)	46 (31%)	379

The table shows that 41% of all institutions responding to the survey were seeking to hire one tenure-track faculty member, 28% were seeking to hire two, and 31% were seeking to hire three or more tenure-track faculty members. Not surprisingly there is variation based on the type of institution with 78% of BS/BA institutions reporting they sought to hire one faculty member while 68% of PhD100 institutions reported seeking to hire three or more.

The last column in Table 1 shows that the 148 institutions reported seeking to fill a total of 379 tenure-track faculty positions (vs. 355 in 2019). The largest number (191) of these positions are for PhD100 institutions with MS institutions reporting the smallest number (43).

A natural and important question to ask is if the institutions responding to the survey are representative of all institutions seeking to hire tenure-track faculty for 2022. As a means to answer this question we examined four sets of institutions in terms of the number of positions they were seeking to hire. The first set (Nov21Ads) uses total positions for all institutions with ads placed by November 15, 2021, which were the set of ads used for the analysis of needs report [2]. The second set (2022Ads) uses total positions of ads for 2022 tenure-track positions placed by the end of the 2021 calendar year, which is the set of faculty invite to participate in the survey. The third set (SurveyAds) uses the total positions specified in the ads placed by the survey-responding institutions. The final set (SurveyResp) uses the total positions reported by survey respondents.

Figure 1 shows the representation for each degree type of institution for each of the four sets of institutions. The relative proportions are shown for each of institutions and faculty positions. The relative proportion of all types of responding institutions (SurveyResp) are within 10% percent of the 2022Ads set with PhD100 institutions responding at higher rates and PhDMore as well as MS institutions responding at lower rates.

<sup>1</sup><http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-science-schools/computer-science-rankings>

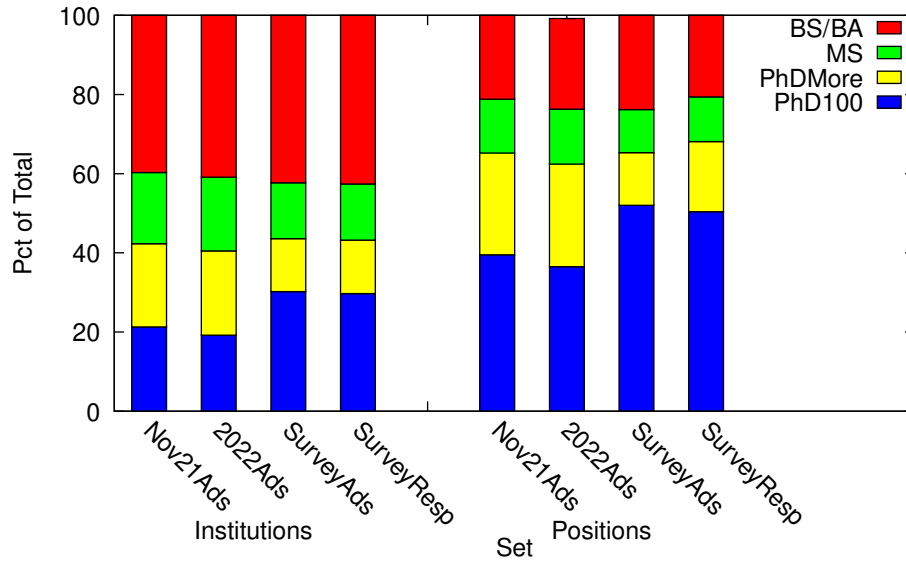


Figure 1: Comparison of Institution and Position Percentages by Highest Degree Offered

Similarly the relative proportion of all positions for responding institutions are generally within 10% of all positions for the 2022Ads set except for the PhD100 institutions. As described in [2] determining the number of positions being sought by an institution based on an ad is not always clear. Non-specific phrases include “multiple positions,” “several positions” or just “positions.” Position proportions in Figure 1 based on ads use an estimate of three positions for such non-specific searches. We note that 22% (32/148) of the institutions responding to the survey used non-specific numbers of positions in their ads. Using survey results for these institutions, we obtain a median of 3 and a mean of 3.9 for the actual number of positions being sought. We also observe that the ads of the remaining institutions indicated specific numbers of positions for a total of 190, yet the survey respondents for these institutions responded with a total of 248 positions seeking to be filled. These discrepancies indicate that the number of positions in ads are only an approximation of the actual number being sought.

The end result is that the relative closeness of proportions between the complete set of institutions and those responding to the survey allow us to have confidence that results for the responding set are representative of the larger set.

An addition to the ads dataset compiled for [2] allows us to also analyze the results based on whether a response is from a U.S. public, U.S. private or non-U.S institution. Table 2 shows results for positions being sought using this institution type combined with highest degree offered. For this analysis, PhD100 and PhDMore institutions are combined as are MS and BS/BA. Six non-U.S. institutions responding to the survey are dropped in this analysis.

The results show that many more public (37) than private (21) PhD institutions responded to the survey. In contrast more private MS&BS/BA institutions (52) responded in comparison to public MS&BS/BA institutions (32). Responses for private institutions reported seeking only a single position at a higher rate than for public institutions. This result is consistent with results reported in [2].

Table 2: Summary of Faculty Positions Sought by Institution Type and Highest Degree Offered

Type/ Degree	Number of Institutions	Number of Positions Sought			Total Positions
		1	2	3+	
Pub/PhD	37	3 (8%)	9 (24%)	25 (68%)	157
Prv/PhD	21	4 (19%)	7 (33%)	10 (48%)	67
Pub/MB	32	9 (28%)	18 (56%)	5 (16%)	61
Prv/MB	52	44 (85%)	8 (15%)	0 (0%)	60
All	142	60 (42%)	42 (30%)	40 (28%)	345

### 3.2 Positions Being Filled

The survey results provide more precise, but similar information on positions being sought as obtained from posted ads. However the survey is needed to understand the success of institutions in filling these positions. Table 3 shows the number of tenure-track faculty positions filled based on the responses by the 148 institutions participating in the survey. The table shows these institutions reported filling a total of 289 positions with PhD100 institutions filling the most positions with 169 and MS institutions filling the least with 23.

Table 3: Summary of Positions Filled by Highest Degree Offered

Highest Degree	Number of Institutions	Number of Positions Filled				Total Positions	Overall Success %
		0	1	2	3+		
PhD100	44	1 (2%)	5 (11%)	11 (25%)	27 (61%)	169	88%
PhDMore	20	1 (5%)	7 (35%)	2 (10%)	10 (50%)	53	79%
MS	21	6 (29%)	8 (38%)	6 (29%)	1 (5%)	23	53%
BS/BA	63	23 (37%)	36 (57%)	4 (6%)	0 (0%)	44	56%
All	148	31 (21%)	56 (38%)	23 (16%)	38 (26%)	289	76%

Looking at the number of positions filled by each institution we see 21% of all institutions reported having a “failed” search where no faculty positions were filled (it was 13% in 2019). 37% of BS/BA institutions reported having failed searches (vs. 26% previously). Not surprisingly, PhD100 institutions had the lowest proportion of failed searches (2%) and the highest proportion making three or more hires (61%).

The last column in Table 3 combines results from it and Table 1 to show an overall search success rate of 76% where 289 positions were filled out of a total of 379 positions being sought. As expected there is variation across institution types with PhD100 institutions having an overall 88% success rate, PhDMore having a 79% rate, BS/BA having a 56% rate and MS having a 53% success rate. While the overall success rate is comparable, these results show a sharper distinction between PhD and non-PhD institution success rates than in the 2019 results.

Table 4 shows the same results as Table 3 based on classifying institutions by type and highest degree offered. Combining with results from Table 2, both public and private PhD institutions show similar overall success rates of 90% and 82%, but public and private MS&BS/BA institutions have

much lower overall success rates of 52% and 58%. Again, the PhD success rates are higher and the non-PhD rates are lower than the 2019 results.

Table 4: Summary of Positions Filled by Institution Type and Highest Degree Offered

Type/ Degree	Number of Institutions	Number of Positions Filled				Total Positions	Overall Success %
		0	1	2	3+		
Pub/PhD	37	2 (5%)	5 (14%)	7 (19%)	23 (62%)	142	90%
Prv/PhD	21	0 (0%)	6 (29%)	6 (29%)	9 (43%)	55	82%
Pub/MB	32	10 (31%)	13 (41%)	8 (25%)	1 (3%)	32	52%
Prv/MB	52	19 (37%)	31 (60%)	2 (4%)	0 (0%)	35	58%
All	142	31 (22%)	55 (39%)	23 (16%)	33 (23%)	264	77%

As comparison, Table F2 in the 2021 Taulbee Survey [3] presents similar aggregate search results for PhD-granting institutions in 2020-21. Those results report a tenure-track search success rate of 80% (284/356) for all U.S. Computer Science Departments in 2021. This success rate is a bit below the combined success rate for U.S. PhD-granting (Pub/PhD and Prv/PhD) institutions of 88% (197/224) in our 2022 survey responses.

### 3.3 Positions Being Filled for Each Institution

A problem with the aggregated results is they do not take into account the specific results for each institution. For example, an institution seeking to hire three faculty and only hiring two is not a “failed” search, but it is less than successful. In contrast an institution may be seeking two faculty, but it is more than successful in being able to hire three faculty. The result is an aggregated success of 100% (5/5) for these two institutions, where the results of the individual searches is lost.

As a means to analyze the search results for each of the 148 institutions responding to the survey seeking to fill at least one faculty position, we defined four categories of institutional search results:

1. *failed* if no faculty were hired,
2. *less than successful* if the number of faculty hired was at least one, but less than the number being sought,
3. *success* if the number of faculty hired was that same as the number being sought, and
4. *more than successful* if the number of faculty hired was more than the number being sought.

Figure 2 shows the percentage of institutions in each of these categories based both on the number of positions sought as well as the institution type. The left grouping in the figure shows that 21% of all searches for all types of institutions failed, 24% were less than successful, 49% of searches were a success and 6% were more than successful. Overall, 55% of institutions responding to the survey reported success or more in their search. This result is comparable to the 56% reported for 2019 results. The first grouping also shows that 32% (vs. 24% in 2019) of all single-position searches failed with the remaining at least succeeding. Two-position searches failed for

24% (vs. 13% in 2019) past years) of institutions and were at least successful for 40% (compared to 50% in 2019) of institutions. Finally, searches for three or more positions failed for 4% of institutions and were at least successful for 50% (vs. 36% in 2019) of institutions.

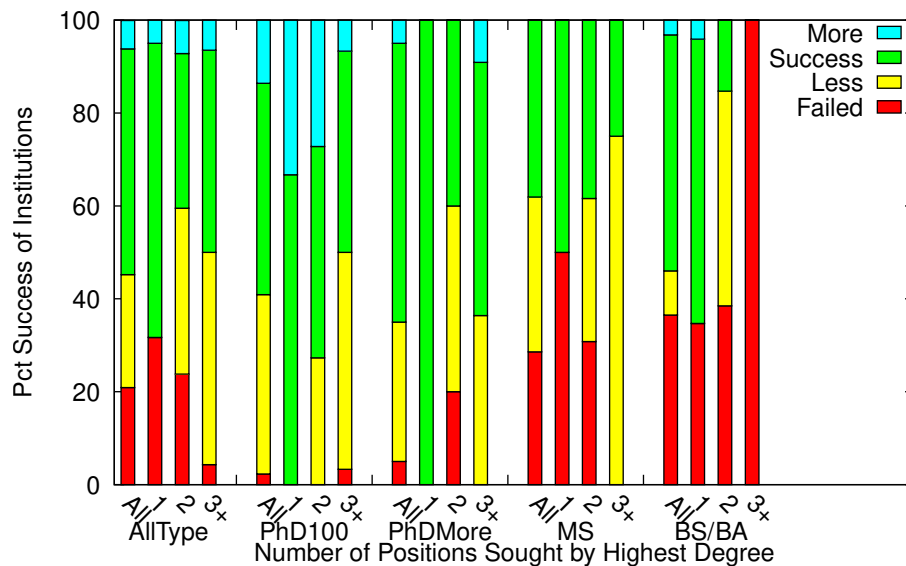


Figure 2: Percentages of Search Success by Highest Degree Offered

The remaining groupings in Figure 2 show the breakdown based on highest degree offered. Searches for all PhD100 institutions failed for 2% and were at least successful for 59%. Searches for all PhDMore institutions failed for 5% and were at least successful for 65%. Searches for all MS institutions failed for 29% and were at least successful for 38%. Searches for all BS/BA institutions failed for 37% and were at least successful for 54%. These percentages indicate that PhDMore and PhD100 institutions were the most successful. MS and BS/BA institutions both report relatively high failure rates.

Figure 3 shows a similar breakdown based on a combination of institution type and highest degree offered. Searches for all public PhD institutions failed for 2% and were at least successful for 59%. Searches for all private PhD institutions failed for 5% and were at least successful for 65%. Searches for all public MS&BS/BA institutions failed for 29% and were at least successful for 38%. Searches for all private MS&BS/BA institutions failed for 37% and were at least successful for 54%. These percentages again show relatively high failure rates for both public and private MS&BS/BA institutions. Both public and private PhD institutions report much lower failure rates and higher success rates.

In comparison, the 2021 Taulbee Survey [3] only aggregates the number of faculty positions filled or unfilled, but does not provide per-institution results. However Table F2a in that report does provide reasons why positions are left unfilled with the top three being 53% due to offers turned down, 22% due to hiring in progress and 14% due to not finding a person who met hiring goals. The report goes on to provide gender and ethnicity information for new hires, which was not collected as part of our survey.

Many of the comments received from our survey respondents had to do with reasons why

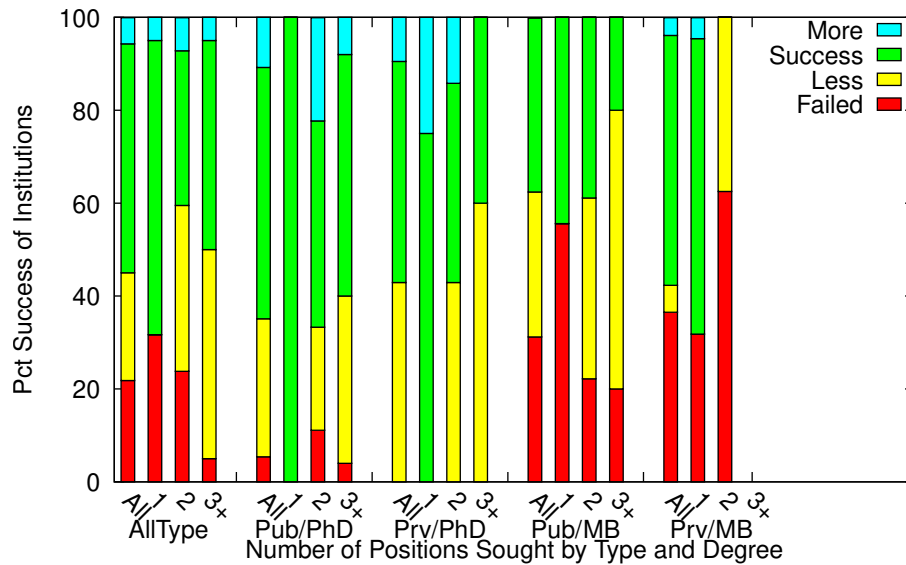


Figure 3: Percentages of Search Success by Institution Type and Highest Degree Offered

institutions were less than successful. These reasons included a reduced number of qualified applicants, the need for increased salaries (and startup packages) leading to failures in hiring candidates or salary inversion with existing faculty, and competition from industry. Other comments included increased competition for available candidates and the need to hire faculty to teach a wide range of courses rather than specific areas.

### 3.4 Previous Position of Hired Faculty

Another question in the survey obtained the previous position held by each of the new faculty that were hired. Table 5 shows the proportion for each type of previous position for all institutions and for institutions based on highest degree offered. Previous positions are ordered based on numbers from most to least for all institutions. Note there may be small inconsistencies in the total number of positions compared to Table 3 due to variations in survey responses for the number of filled positions for different questions.

The results show that 31% of all hired faculty start with a newly-earned PhD, which is up from 23% in 2019. 24% were previously in a tenured or tenure-track position at another institution (vs. 23% in 2019) and 23% were previously in post-doc/researcher positions (vs. 29% in 2019). These again were the three primary previous positions, although the order has changed with newly-earned PhDs now with the highest share and PostDocs dropping to third. The remaining options (non-tenure-track faculty, all-but-dissertation, non-academic and other) at 10% or less.

Results for different degrees offered show that new PhDs are the most prevalent for all types of institution groups. New hires who were previously in tenured/tenure-track positions elsewhere contributed the second highest number for PhD100 institutions with PostDocs the second highest for PhDMore and MS institutions. Previously non-tenure-track faculty accounted for the second largest share of BS/BA hires.



Table 5: Summary of Previous Positions Held for Hired Faculty by Highest Degree Offered

Previous Position	All Types	Highest Degree			
		PhD100	PhDMore	MS	BS/BA
PhD	90 (31%)	51 (30%)	18 (35%)	7 (30%)	14 (30%)
T/TT	70 (24%)	47 (27%)	8 (16%)	5 (22%)	10 (22%)
PostDoc	66 (23%)	45 (26%)	14 (27%)	6 (26%)	1 (2%)
NTT	30 (10%)	11 (6%)	2 (4%)	4 (17%)	13 (28%)
ABD	17 (6%)	7 (4%)	6 (12%)	0 (0%)	4 (9%)
NonAcad	15 (5%)	9 (5%)	3 (6%)	1 (4%)	2 (4%)
Other	3 (1%)	1 (1%)	0 (0%)	0 (0%)	2 (4%)
All	291 (100%)	171 (100%)	51 (100%)	23 (100%)	46 (100%)

Table 6 shows the same results based on institution type and highest degree offered. The relative orderings are similar with newly earned PhDs the highest overall and for the public PhDs, as well as public and private MS&BS/BA institutions. The largest percentage of private PhD institution hires were previously tenured/tenure-track faculty at other institutions.

Table 6: Summary of Previous Positions Held for Hired Faculty by Type and Highest Degree

Previous Position	All Types	Type/Degree			
		Pub/PhD	Prv/PhD	Pub/MB	Prv/MB
PhD	88 (33%)	52 (37%)	15 (27%)	9 (28%)	12 (32%)
T/TT	67 (25%)	34 (24%)	18 (33%)	7 (22%)	8 (22%)
PostDoc	53 (20%)	33 (23%)	13 (24%)	6 (19%)	1 (3%)
NTT	30 (11%)	12 (8%)	1 (2%)	7 (22%)	10 (27%)
ABD	13 (5%)	3 (2%)	6 (11%)	2 (6%)	2 (5%)
NonAcad	12 (5%)	7 (5%)	2 (4%)	1 (3%)	2 (5%)
Other	3 (1%)	1 (1%)	0 (0%)	0 (0%)	2 (5%)
All	266 (100%)	142 (100%)	55 (100%)	32 (100%)	37 (100%)

The 2021 Taulbee Survey does not provide any data on where new faculty hires come from, but Table F5 in that report does provide data on faculty losses. 33% of those losses are due to retirement and another 36% took academic positions elsewhere. This latter figure is the other perspective of the 25% of all new hires (and 26% (52/197) of Pub/PhD and Prv/PhD new hires) in our survey results that came from a tenured/tenure-track position at another institution.

### 3.5 Areas in Which Faculty Were Hired

Our previous report on faculty hiring [2] clustered topics into 16 areas. The table defining these areas and the constituent topics for each is reproduced in Table 7 from the previous report. These same areas (along with a link to this table) were provided to survey respondents to identify the area in which new faculty members were hired.

Table 7: Topics Grouped in Each Clustered Area

Area	Constituent Topics
AI/DM/ML	Artificial Intelligence, AI Ethics/Fairness, Data Mining, Deep Learning, Machine Learning, Multi-Agent Systems, Natural Language Processing, Optimization, Reinforcement Learning, Text Mining
Arch	Architecture, Computer Organization, Hardware
Compiler/PL	Compilers, Programming Languages
CompSci	Biological Computing, Bioinformatics, Biomedical, Biometrics, Computational Biology, Computational Neuroscience, Computational Science, Network Science, Scientific Computation
DataSci	Big Data, Data Analytics, Data Science, Data Systems, Visualization
DB	Databases, Data Management, Information Retrieval, Information Systems
HCI/IntMedia	Affective Computing, Animation, Augmented Reality, Cognitive Science, Entertainment Computing, Games, Human-Computer Interaction, Virtual Reality
ImageSci	Graphics, Image Processing, Pattern Recognition, Vision
Mobile	Human-Centered Computing, Mobile Systems, Pervasive Computing
Robotics/CPS	Autonomous/Vehicular Systems, Cyber-Physical Systems, Embedded Systems, Human-Robotic Interaction, Intelligent Systems, Internet of Things, Robotics
Security	Anonymity, Block Chain, Cryptography, Forensics, Fraud Detection, Privacy, Security, Trusted Computing
SoftEngr	Software Design, Software Development, Software Engineering, Software Quality, Software Systems
Sys/Net	Cloud Computing, Distributed Computing, Edge Computing, High Performance Computing, Networking, Operating Systems, Parallel Computing, Performance Modeling, Storage, System Administration, System Analysis, Systems
Theory/Alg	Algorithms, Formal Methods, Logic, Quantum Computing, Theory, Verification
OtherCS	CS Education, Data Structures, Ethics, Information Science, Information Technology, Introductory CS, Modeling, Simulation, Social Computing, Software, Web Technologies
OtherInter	Astroinformatics, Business Analytics, Computer Engineering, Digital Humanities, Economics Financial Technology, Geospatial, Health, Health Informatics, Interdisciplinary, Learning Science, Medicine, Project Management, Statistics

Table 8 shows the numbers and percentages of hires for all institutions as well as for the highest degree offered. Table rows are ordered based on the number of hires in each area (save for Other) with 81 hires in AI/DM/ML, which constitutes 26% (the same as in 2019) of the 307 total positions. Again the total positions shown may be slightly different than Tables 3 and 5 due to inconsistencies in survey responses.

Table 8: Summary of Areas for Hired Faculty by Highest Degree Offered

Area	All Types	Highest Degree			
		PhD100	PhDMore	MS	BS/BA
AI/DM/ML	81 (26%)	52 (30%)	17 (28%)	6 (26%)	6 (13%)
Security	45 (15%)	22 (12%)	12 (20%)	6 (26%)	5 (11%)
Sys/Net	24 (8%)	12 (7%)	8 (13%)	1 (4%)	3 (6%)
Theory/Alg	19 (6%)	10 (6%)	3 (5%)	0 (0%)	6 (13%)
DataSci	18 (6%)	10 (6%)	2 (3%)	3 (13%)	3 (6%)
HCI/IntMedia	15 (5%)	11 (6%)	2 (3%)	1 (4%)	1 (2%)
Robotics/CPS	14 (5%)	9 (5%)	3 (5%)	1 (4%)	1 (2%)
Compiler/PL	11 (4%)	7 (4%)	3 (5%)	1 (4%)	0 (0%)
Arch	10 (3%)	6 (3%)	2 (3%)	0 (0%)	2 (4%)
SoftEngr	10 (3%)	4 (2%)	2 (3%)	1 (4%)	3 (6%)
DB	8 (3%)	7 (4%)	0 (0%)	0 (0%)	1 (2%)
ImageSci	8 (3%)	6 (3%)	1 (2%)	0 (0%)	1 (2%)
CompSci	7 (2%)	5 (3%)	0 (0%)	1 (4%)	1 (2%)
Mobile	3 (1%)	2 (1%)	1 (2%)	0 (0%)	0 (0%)
OtherCS	20 (7%)	5 (3%)	1 (2%)	2 (9%)	12 (26%)
OtherInter	14 (5%)	8 (5%)	4 (7%)	0 (0%)	2 (4%)
All	307 (100%)	176 (100%)	61 (100%)	23 (100%)	47 (100%)

The table shows that Security accounts for 45 (15%) of all filled positions with Systems/Networking for 24 (8%) and Theory/Alg accounting for 19 (6%) of filled positions. AI/DM/ML was the most popular identified area for the PhD100 and PhDMore groups and it was tied with Security for MS institutions. OtherCS was the most popular “area” for BS/BA institutions as written comments indicated it was important to hire faculty who could teach a wide range of courses. Security was the second-most popular area for PhD100 and PhDMore institutions. AI/DM/ML and Theory/Alg tied for second among BS/BA institutions.

Table 9 shows the same numbers and percentages of hires based on classifying institutions by type and degree offered. Again the AI/DM/ML area was most popular overall and for both public and private PhD institutions. The public MS&BS/BA institutions show Security as most popular with OtherCS as most popular with private MS&BS/BA institutions.

### 3.6 Areas Sought Compared with Areas Filled

While important to understand where hires were made, linking survey results to areas specified in faculty ads allows us to compare the areas for positions that were sought with the areas for

Table 9: Summary of Areas for Hired Faculty by Institution Type and Highest Degree Offered

Area	All Types	Type/Degree			
		Pub/PhD	Prv/PhD	Pub/MB	Prv/MB
AI/DM/ML	72 (26%)	41 (29%)	19 (31%)	6 (20%)	6 (15%)
Security	42 (15%)	24 (17%)	7 (11%)	7 (23%)	4 (10%)
Sys/Net	21 (8%)	13 (9%)	4 (6%)	2 (7%)	2 (5%)
DataSci	18 (7%)	4 (3%)	8 (13%)	4 (13%)	2 (5%)
Theory/Alg	16 (6%)	6 (4%)	4 (6%)	2 (7%)	4 (10%)
HCI/IntMedia	13 (5%)	4 (3%)	7 (11%)	1 (3%)	1 (2%)
Robotics/CPS	12 (4%)	8 (6%)	2 (3%)	1 (3%)	1 (2%)
Compiler/PL	9 (3%)	7 (5%)	1 (2%)	1 (3%)	0 (0%)
SoftEngr	9 (3%)	4 (3%)	1 (2%)	1 (3%)	3 (8%)
Arch	8 (3%)	5 (3%)	1 (2%)	0 (0%)	2 (5%)
DB	8 (3%)	5 (3%)	2 (3%)	0 (0%)	1 (2%)
ImageSci	8 (3%)	5 (3%)	2 (3%)	0 (0%)	1 (2%)
CompSci	7 (3%)	4 (3%)	1 (2%)	1 (3%)	1 (2%)
Mobile	2 (1%)	2 (1%)	0 (0%)	0 (0%)	0 (0%)
OtherCS	20 (7%)	6 (4%)	0 (0%)	4 (13%)	10 (25%)
OtherInter	10 (4%)	5 (3%)	3 (5%)	0 (0%)	2 (5%)
All	275 (100%)	143 (100%)	62 (100%)	30 (100%)	40 (100%)

positions that were filled. This analysis was done by filtering the ads dataset to include only the 148 institutions that responded to the survey. We then repeated analysis that was done in [2] to determine the percentage of positions sought in each of the 16 areas. As was previously done, institutions not identifying specific areas in their original ad did not contribute to this analysis. Ads for the survey institutions identified specific areas for 67% of the advertised positions, which is a bit smaller than the 2022Ads dataset.

Figure 4 shows the results of scatter plotting each of the 16 areas based on their percentages of positions sought vs. positions filled for all 148 institutions regardless of type. Areas further from the origin represent the most popular areas. Areas close to the diagonal (a line is drawn for reference) are areas in which the percentage of positions filled is roughly the same as positions sought. Areas plotted above the diagonal indicate a higher percentage of positions were filled than were sought. Areas plotted below the diagonal indicate a higher percentage of positions were sought than were reported to be filled. Only “notable” areas further from the origin are labeled in this and subsequent plots for better readability.

Below the diagonal, DataSci was sought for 16% of positions, but reported to be filled for only 6% of positions. Similarly, Security was sought for 19% of positions, but only 15% of positions were filled in this area. Sys/Net and SoftEngr areas are also below the diagonal with a net difference of 3% between sought and filled percentages. Above the diagonal, the AI/DM/ML area has 11% net more filled than sought positions. HCI/IntMedia has a net difference of 3% with other areas having a net difference of 2% or less between sought and filled positions.

Many factors contribute to the areas with the largest discrepancies between percentages of positions sought and filled. These factors include:

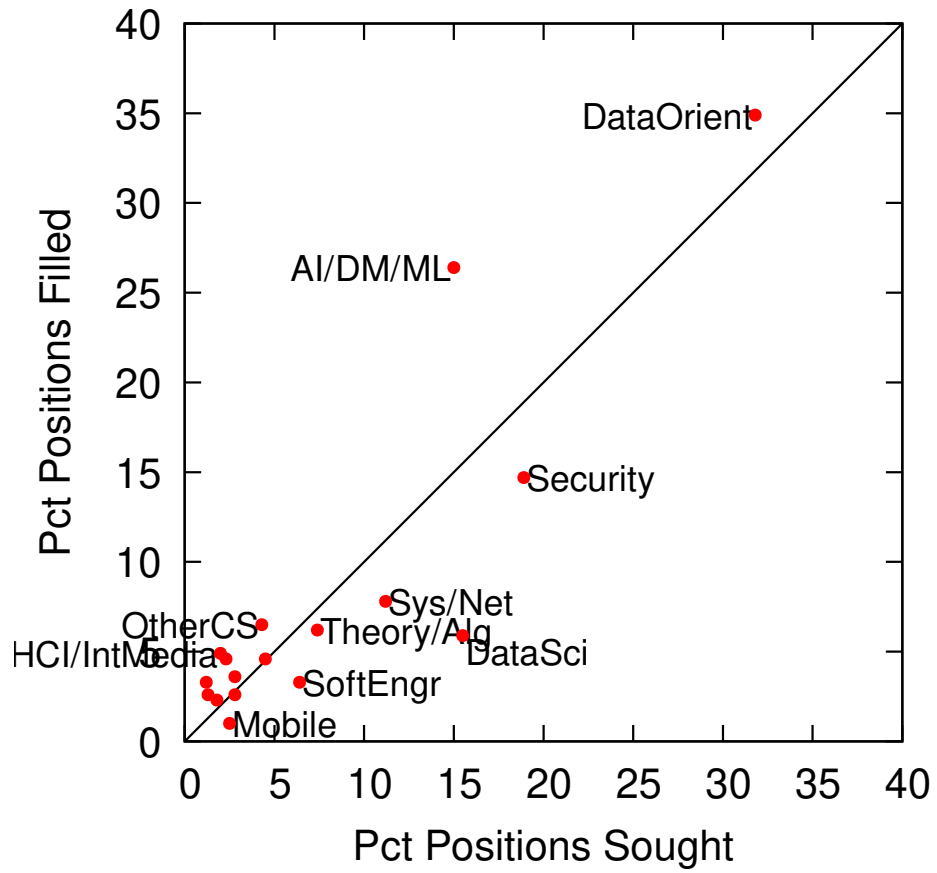


Figure 4: Percentages of Areas Sought vs. Areas Filled for All Institutions

1. A third (33%) of positions filled were from institutions not identifying areas of interest in their ad. It is possible that areas being sought by these institutions did not match the same distribution of areas as discerned from ads that did identify areas of interest.
2. Institutions simply did not hire in the areas of interest. These institutions either could not find candidates in an area of interest or they found better candidates in other areas. Some written comments indicated such outcomes.
3. A filled position was actually in a sought area, but the area discerned from the ad simply did not match the identified area of the hire in the survey. For example, an institution could have advertised for a hire in Data Analytics (in the area of DataSci as shown in Table 7), but identified the hire in the survey as being in the area of AI/DM/ML. In [2] we addressed this specific issue by further clustering the AI/DM/ML, DataSci and DB areas into a data-oriented “DataOrient” area. As shown in Figure 4, this aggregated area accounted for 32% of sought positions and 35% of filled positions.

### 3.7 Areas Sought Compared with Areas Filled By Institution Type

Figures 5 and 6 repeat the same analysis after dividing all institutions into PhD-granting (PhD100 and PhDMore) and non-PhD-granting (MS and BS/BA) institutions. As reference, results in Table 3 show that 77% of filled positions were done so by PhD-granting institutions.

Figure 5 for PhD institutions shows a larger share of positions in data-oriented areas (33% of sought and 37% of filled positions) than the results shown in Figure 4. DataSci is the most notable area below the diagonal with 13% sought and 5% filled. Above the diagonal, the AI/DM/ML area has 19% sought, but 29% filled and HCI/IntMedia accounts for 2% of sought positions, but 5% of filled positions..

Figure 6 for MS and BS/BA institutions shows that 30% of sought and 27% of filled positions are in the DataOrient aggregated area. Above the diagonal on the right, the OtherCS area has the largest net discrepancy with 6% of sought positions, but 20% of filled positions indicating many hires over a breadth of areas. Below the diagonal, DataSci has the largest difference with 20% of sought and 9% of filled positions, while Security has the next largest difference with 24% of sought, but only 16% of filled positions.

### 3.8 Faculty Hiring and PhD Production

The 2021 Taulbee Survey [3] does not provide any information on areas in which faculty were sought or hired, but Table D4 in that report does provide information on “specialties” in which PhDs were produced as part of results on employment of new PhD recipients. These 2021 data are one year removed from the 2022 faculty hiring season, but provide a means to compare areas of PhD production with areas of faculty hiring.

For this analysis we use the grand total of all PhDs produced with a “known” specialty regardless of their subsequent employment. Table 10 shows the number (and percentage based on the total known) sorted in decreasing order for each specialty as given in [3]. No additional explanation for the content of each specialty beyond the name is provided in the text of that report.

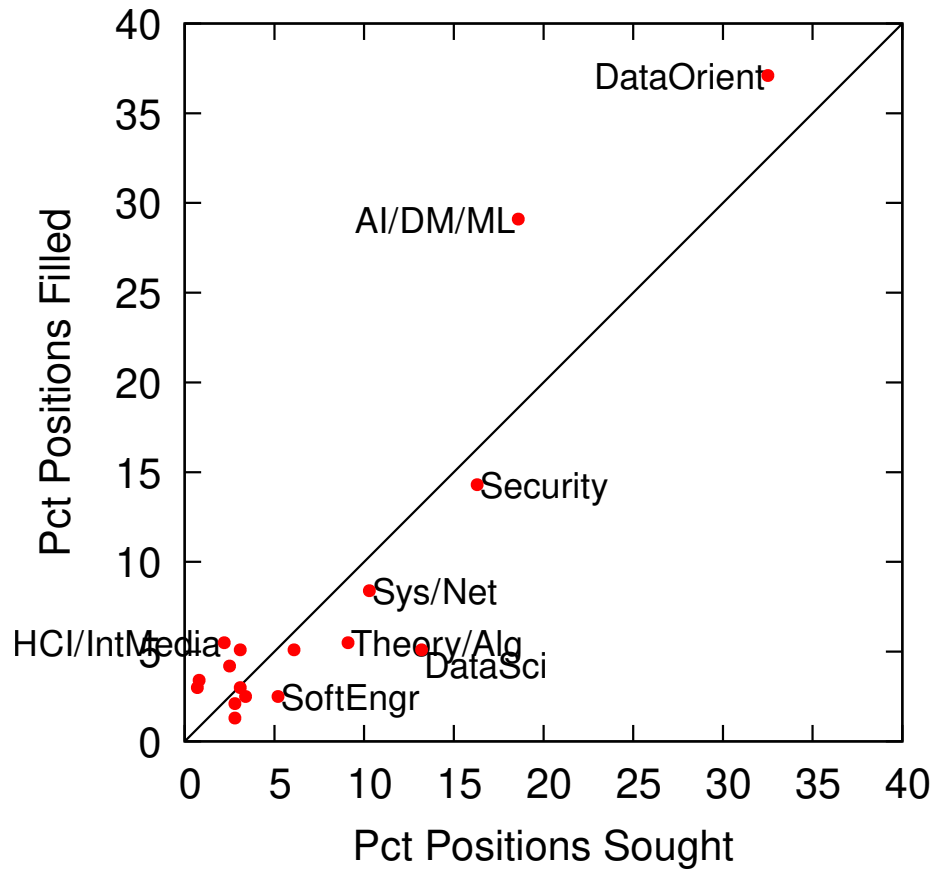


Figure 5: Percentages of Areas Sought vs. Areas Filled for PhD Institutions

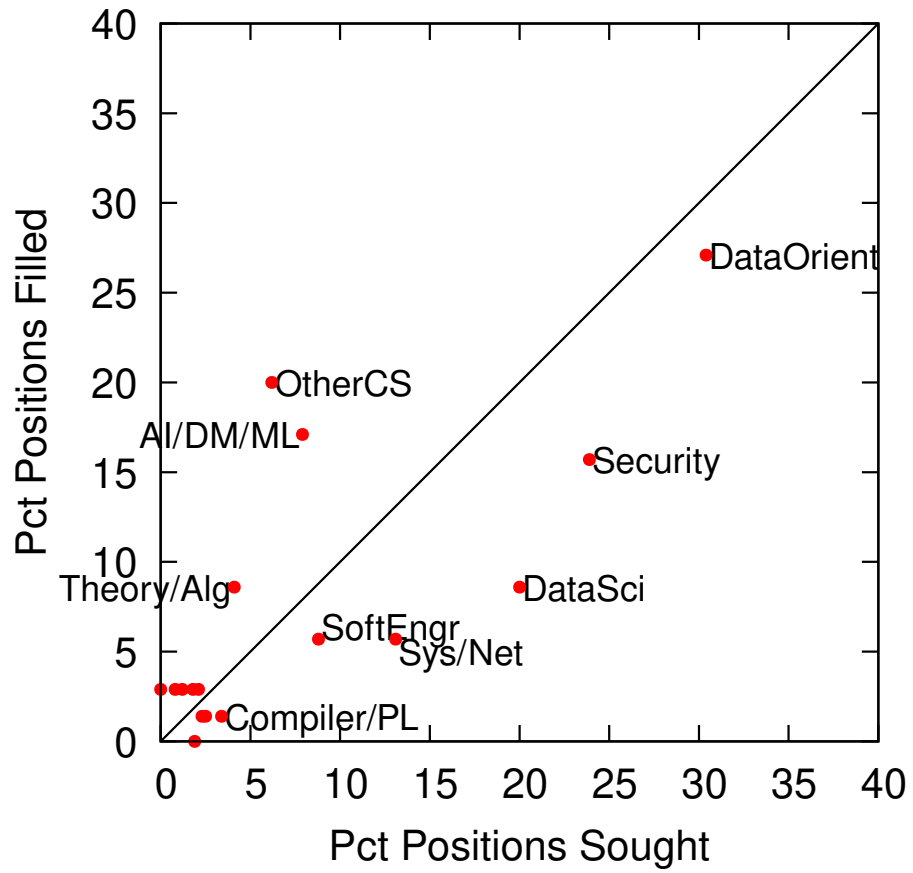


Figure 6: Percentages of Areas Sought vs. Areas Filled for MS&BS/BA Institutions



Table 10: 2021 Taulbee Survey New PhD by Specialty

Specialty	Cnt (%)	Corresponding Area
Artificial Intelligence/Machine Learning	362 (25%)	AI/DM/ML
Software Engineering	102 (7%)	SoftEngr
Security/Information Assurance	90 (6%)	Security
Networks	83 (6%)	Sys/Net
Human-Computer Interaction	83 (6%)	HCI/IntMedia
Databases/Information Retrieval	70 (5%)	DB
Robotics/Vision	70 (5%)	Robotics/CPS
Theory and Algorithms	70 (5%)	Theory/Alg
Hardware/Architecture	68 (5%)	Arch
Graphics/Visualization	67 (5%)	ImageSci
Informatics: Biomedical/Other Science	60 (4%)	
Operating Systems	52 (4%)	Sys/Net
Programming Languages/Compilers	46 (3%)	Compiler/PL
Social Computing/Social Informatics	40 (3%)	
Computing Education	32 (2%)	
Information Science	30 (2%)	
High-Performance Computing	26 (2%)	Sys/Net
Information Systems	22 (1%)	
Scientific/Numerical Computing	13 (1%)	CompSci
Other	91 (6%)	
Total Known	1477 (100%)	

The last column in Table 10 shows the corresponding area from Table 7 that matches each specialty. In cases where a good match is not clear then no corresponding area is shown. Not all of the correspondences are an exact fit with “Robotics/Vision” a specialty where we define “Robotics/CPS” as an area with the topic of Vision in the ImageSci area. Similarly, the “Graphics/Visualization” specialty is mapped to the ImageSci area even though the topic of Visualization is clustered under the DataSci area. The result is that 12 of the 18 areas from Table 7 are associated with a specialty in Table 10.

Figures 7 and 8 plot the percentage of PhDs produced against the percentage of faculty positions sought and the percentage of faculty positions filled for all institutions (as previously shown in Figure 4). The 12 areas most clearly corresponding to specialties in Table 10 are shown in each graph.

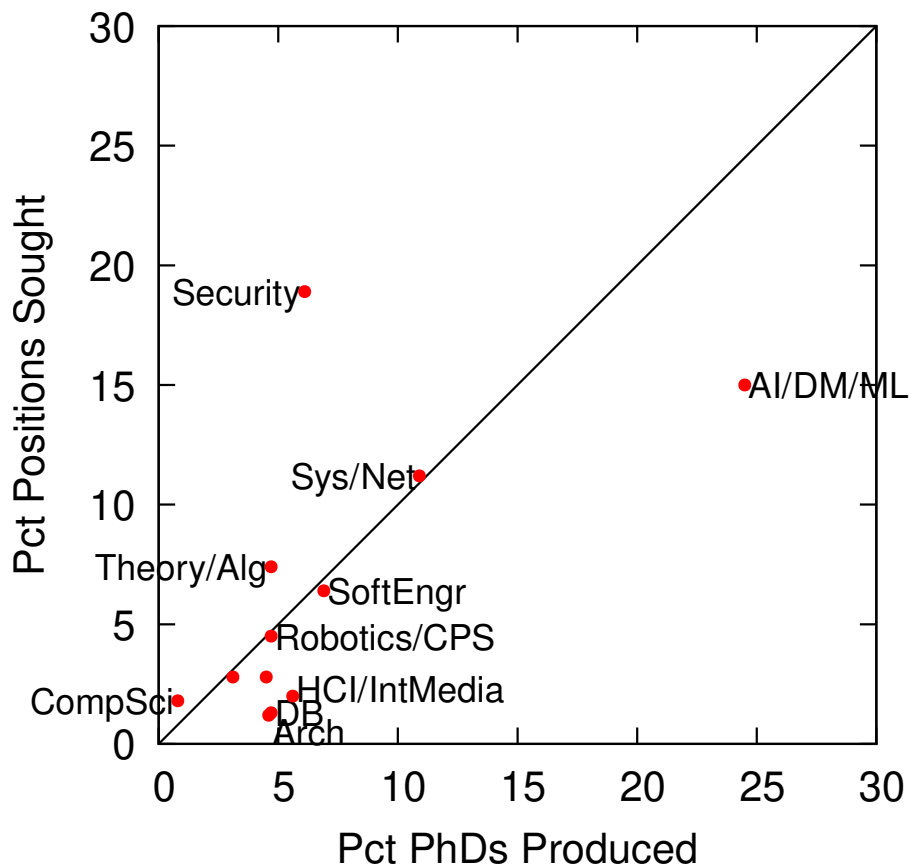


Figure 7: Percentages of Areas of PhDs Produced vs. Areas Sought for All Institutions

In Figure 7, Security is the area with most obvious discrepancy between percentage of PhDs produced (6%) and faculty positions sought (19%). There is also a large discrepancy between percentage of PhDs produced (25%) and positions sought (15%), but this difference is less significant as sought positions in DataSci are not included in these results. Most other areas are relatively

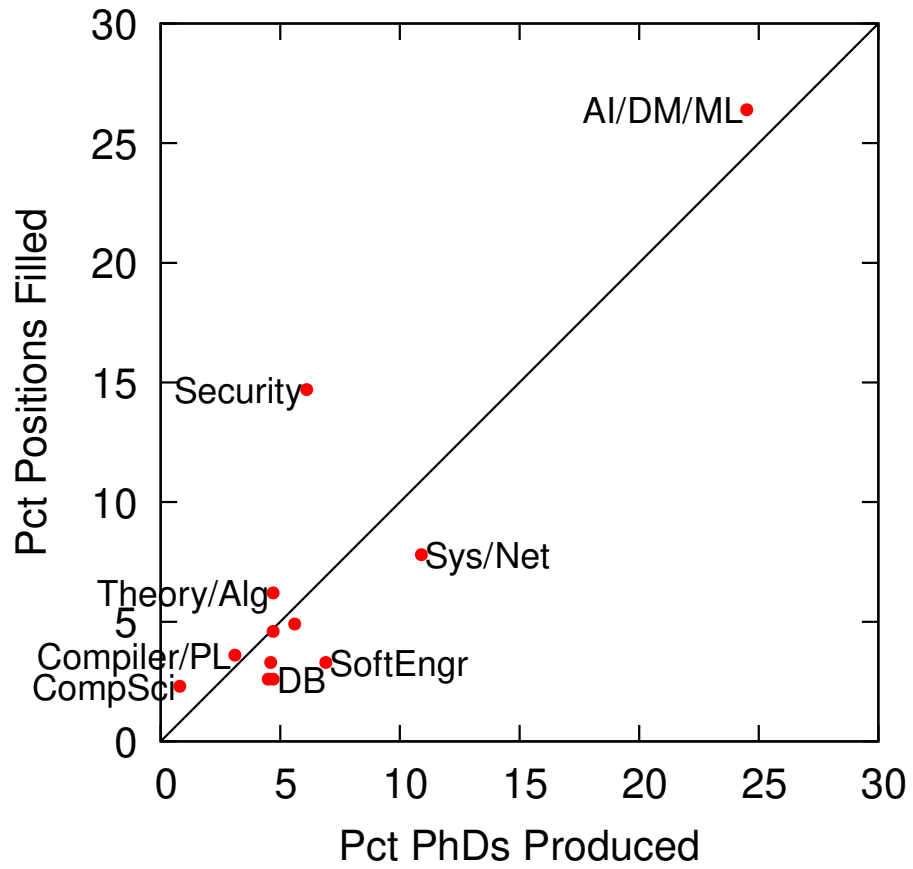


Figure 8: Percentages of Areas of PhDs Produced vs. Areas Filled for All Institutions

close to the diagonal indicating similar percentages of PhDs produced and positions sought.

In Figure 8, the percentage of PhDs produced and positions filled for the AI/DM/ML area is comparable. Security has the biggest discrepancy with 6% of PhDs produced, but 15% of positions filled. On the other side of the diagonal, SoftEngr (4%) and Sys/Net (3%) have the highest net percentage discrepancy of PhDs produced more than positions filled.

## 4 Summary and Future Work

This work directly follows previous work that analyzed current and future Computer Science needs via advertised tenure-track faculty searches for 2022. This follow-on work looked to understand the relative success of institutions in hiring the tenured/tenure-track faculty in the areas of Computer Science that were being sought. This work also follows on a similar study of tenure-track faculty hiring outcomes last done in the pre-Covid impacted year of 2019.

Responses to a survey were obtained from 148 institutions that reported seeking tenure-track faculty in 2022. The distribution of survey responses based on institutional type was in roughly the same proportion as for all institutions that were searching for tenure-track faculty. Survey respondents reported seeking a total of 379 faculty positions.

Survey respondents reported filling a total of 289 tenure-track faculty for an aggregate success rate of 76%, which is comparable to the 2019 study. Examination on the success of the search for each of the 148 institutions found that 21% of institutions failed to hire any faculty, while 55% succeeded in hiring at least as many faculty as were being sought. These failed search results are worse than, and the institutional success results are comparable to, survey results from 2019. In terms of results for different types of institutions, PhD institutions reported failed search rates of only a few percent and at least successful searches for more than 60% of institutions. In contrast, BS/BA (37%) and MS (29%) institutions reported a much higher percentage of failed searches. There was also a lower percentage of successful searches with 38% for MS and 54% for BS/BA institutions.

Reported results on the previous position for hired faculty show that three types of such positions continue to be most prevalent. 31% of hired faculty start with a newly-earned PhD, 24% were previously in a tenured or tenure-track position at another institution, and 23% were previously in a post-doc/researcher position. The newly-earned PhD results are higher than results from a similar study in 2019 and the post-doc results are lower indicating more hires of new faculty with less experience.

Survey respondents reported on the number of hires in each of 16 clustered areas. The clustered area of AI, Data Mining and Machine Learning (AI/DM/ML) accounted for 26% of the filled positions (comparable to 2019). Security accounted for the next most with 15% of the filled positions (similar to 15% in 2019) while Systems/Networking (8%), Theory/Algorithms (6%) and Data Science (6%) were the next areas in terms of filled positions. Further clustering of results for the AI/DM/ML, Databases and Data Sciences areas finds that 35% of hires were “Data Oriented,” which is up from 33% in 2019.

In comparing the areas of filled positions with the areas in which positions were sought, the AI/DM/ML area shows the biggest net positive difference percentage of positions filled and sought. In contrast, the area of Security showed similar (compared with 2019) negative difference with 15% of filled positions, but 19% of sought positions. The area of DataSci had a 10% negative net

percentage difference between filled and sought positions. Data-oriented areas accounted for 32% of sought positions and 35% of filled positions.

A final analysis uses Taulbee Survey results to compare areas for PhD production with area of faculty positions sought and filled. Security is the area with most obvious discrepancy between percentage of PhDs produced (6%) and faculty positions sought (19%). Security is the area with the highest discrepancy between PhDs produced and positions filled with a net of 9% more positions filled than PhDs produced.

A direction for future work is to continue to improve the survey instrument. Continued collection of ad data and subsequent surveys allows the success of faculty hiring to be tracked over time. Better integration with the Taulbee Survey could help to understand why searches succeed or fail.

## Acknowledgment

We would like to acknowledge the 148 institutions that responded to the survey. A list of these institutions is included in Appendix B. Without these responses this report would not be possible. A better understanding on the relative success of faculty hiring in Computer Science is important for us all. Thank you.

## References

- [1] Craig E. Wills. 2019 computer science tenure-track faculty hiring outcomes. *Computing Research News*, 31(10), November 2019. See technical report for details of study.  
<http://www.cs.wpi.edu/~cew/papers/outcomes19.pdf>.
- [2] Craig E. Wills. Analysis of current and future computer science needs via advertised faculty searches for 2022. *Computing Research News*, 34(1), January 2022. See technical report for details of study.  
<http://www.cs.wpi.edu/~cew/papers/CSareas22.pdf>.
- [3] Stuart Zweben and Betsy Bizot. 2021 CRA Taulbee Survey. *Computing Research News*, 34(5), May 2022.

# A Survey

The following shows the instructions and questions used for the survey completed by respondents. All numeric questions are answered with a radio-button selection of 0, 1, 2, 3, 4, 5-6, 7-8, or 9+. No response for a question is mapped to 0.

## A.1 Questions

- Q1** Please complete the following short survey concerning your department's outcome in hiring of tenured/tenure-track Computer Science (or closely related program) faculty in 2022. At the end of the survey you will be able to see tabulated results from other respondents. An analysis of the results will be made available to the community similar to the report on hiring outcomes from 2019 available at <https://web.cs.wpi.edu/~cew/papers/outcomes19.pdf>. Again this survey is only for the hiring of tenured/tenure-track faculty. Thank you
- Q2** How many tenured/tenure-track faculty were you seeking to hire in 2022 (to begin in 2022 or 2023)?
- Q3** How many tenured/tenure-track faculty have you hired in 2022 (to begin in 2022 or 2023)?
- Q4** How many tenured/tenure-track faculty were hired in each of these area clusters (total across all areas should reflect the total number of hired faculty)? As reference, constituent topics for each area are available at <https://web.cs.wpi.edu/~cew/papers/topicareas22.pdf>
- AI/Data Mining/Machine Learning
  - Architecture
  - Compilers/Prog Languages
  - Computational Science
  - Data Science
  - Databases
  - Human Computer Interaction/Interactive Media
  - Image Science
  - Mobile/Ubiquitous Computing
  - Robotics/Cyber-Physical Systems
  - Security
  - Software Engineering
  - Systems/Networking
  - Theory/Algorithms
  - Other CS
  - Other Interdisciplinary
- Q5** How many tenure/tenure-track faculty were hired with the immediately-preceding position (total across all previous positions should reflect the total number of hired faculty)?
- All, But Dissertation
  - Newly Completed PhD
  - Post Doc/Researcher
  - Other Non-Tenure-Track Faculty Position

Tenured/Tenure Track Position at Another Institution  
Non-Academic Position  
Other

- Q6** Please provide any additional feedback you would like to provide on hiring tenured/tenure-track faculty in 2022. Any feedback will not be shared in the public survey tabulation.  
[Open Text Response]
- Q7** After continuing from this page you are done with the survey and will be redirected to a link showing numerical tabulation of results received thus far. Thank you for your contribution.  
[Respondents redirected to page showing aggregated responses for Q2-Q5.]

## B Participating Institutions

The following 148 institutions provided responses to the survey. They are listed based on highest degree offered with PhD institutions sub-divided if they have a top-100 U.S. ranking. Institutions are further denoted as public U.S. (no designation), private U.S. (designated with \*), or non-U.S. (designated with †).

### B.1 PhD100

Arizona, Auburn, BostonU\*, Brown\*, Buffalo, CalRiverside, CaseWestern\*, CentralFlorida, Chicago\*, Clemson, Colorado, ColoradoSt, Columbia\*, CornellTech\*, Duke\*, Emory\*, FloridaSt, GeorgeMason, GeorgeWashingtonU\*, Illinois, Indiana, Iowa, IowaSt, Kentucky, Maryland, Mass, Michigan, Minnesota, NewJerseyInstTech, Northeastern\*, NotreDame\*, OhioState, Penn\*, Princeton\*, Rochester\*, RochesterInstTech\*, Rutgers, Stanford\*, TexasA&M, TexasArlington, Utah, WPI\*, WashingtonU\*, William&Mary.

### B.2 PhDMore

Alabama, AlabamaBirmingham, AustralianNatU†, BritishColumbia†, Dalhousie†, EPFL†, Lehigh\*, Maine, Mississippi, NevadaReno, NewSouthWalesSydney†, NorthTexas, OklahomaSt, SUNY-Binghamton, TennesseeTech, TexasSt, UMiami\*, USydney†, VirginiaCommonwealth, WakeForest\*.

### B.3 MS

AppalachianSt, ArkansasSt, BallSt, CalStChico, CentralOklahoma, DelawareSt, EmbryRiddle\*, JacksonvilleSt, LSUShreveport, LoyolaChicago\*, MiamiU, MissouriSt, NewMexicoInstMT, NorthCarolinaGreensboro, NorthFlorida, PurdueNorthwest, QueensCollegeCUNY, RowanU, StCloudSt, TexasRioGrande, WisconsinWhitewater.

### B.4 BS

Albright\*, Augsburg\*, Barnard\*, Belmont\*, BerryCollege\*, BloomsburgU, BridgewaterSt, BrynMawr\*, Bucknell\*, Canisius\*, Cedarville\*, CentralMethodist\*, CentralWashington, CentreCollege\*, Colgate\*, ConnecticutColl\*, CurryCollege\*, DePauw\*, Drake\*, EasternU\*, FloridaSouthern\*, GeorgiaCollege, Gonzaga\*, HobartWilliamSmith\*, IndianaWesleyan\*, Iona\*, Lewis&Clark\*, Longwood, LutherCollege\*, MeredithCollege\*, Middlebury\*, MountUnion\*, OtterbeinU\*, OxfordEmory\*, ProvidenceColl\*, PugetSound\*, RiponCollege\*, Rose-Hulman\*, SaintJosephConn\*, Simmons\*, SiouxFalls\*, SouthCarolinaSumter, SouthwesternU\*, StBonaventure\*, StEdward's\*, StJohnFisherC\*, StLawrence\*, StMarysCollegeMd, StNorbert\*, Stockton, SusquehannaU\*, Swarthmore\*, TennesseeMartin, Transylvania\*, TrumanSt, Vassar\*, WesleyanU\*, WestGeorgia, Westmont\*, WhitmanCollege, Wittenberg\*, Wooster\*, WorcesterStU.