Outcomes of Advertised Computer Science Faculty Searches for 2017

Craig E. Wills

Professor and Department Head
Computer Science Department
Worcester Polytechnic Institute
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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 2017. 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.

Responses to a survey were obtained from 155 institutions that reported seeking tenure-track faculty in 2017. Survey respondents reported seeking 323 tenure-track faculty positions and filling 241 such positions for an aggregate success rate of 75%. Examination on the success of the search for each of the institutions found that 18% failed to hire any faculty, while 53% succeeded in hiring at least as many faculty as were being sought.

Reported results on the previous position for hired faculty show that three types of such positions predominant. 31% of hired faculty start with a newly-earned PhD, 26% were previously in a post-doc/researcher position, and 26% were previously in a tenured or tenure-track position at another institution.

In comparing the areas of filled positions with the areas in which positions were sought, the clustered area of AI, Data Mining and Machine Learning showed the biggest positive difference with 21% of filled positions, but only 11% of sought positions. The Theory/Algorithms area showed the second biggest positive net percentage difference of 6% between percentage of positions filled and sought. In contrast, the area of Security showed the biggest negative difference with 12% of filled positions, but 23% of sought positions.

Taulbee Survey results were used to compare areas of PhD production with areas of faculty positions sought and filled. Security is the area with most obvious discrepancy between percentage of PhDs produced (6%) and faculty positions sought (23%). AI/DM/ML and Security are the areas with the highest discrepancy between PhDs produced and positions filled with a net of 8% and 7% more positions filled than PhDs produced.

In summary, the results show a mix of success with just over 50% of institutions hiring at least the number of faculty they were seeking. In terms of areas, AI/DM/ML and Data Science collectively represent 28% of positions filled, although PhD production in these areas was not this high. There was much stronger demand for positions in Security than PhD production or positions actually filled.

1 Introduction

This work directly follows previous work analyzing current and future Computer Science needs via advertised tenure-track faculty searches for 2017 [1]. The work seeks to understand the relative success of institutions in hiring the tenured/tenure-track faculty in the areas that were being sought.

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 [1]) as well as pertinent results reported in the 2016 Taulbee Survey of PhD-producing Computer Science departments [2]. 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 443 institutions (some with multiple search contacts) in September 2017. These institutions placed ads between August and December 2016 for tenure-track positions to begin in 2017. The previous report on hiring needs [1] was based on ads placed by 347 institutions prior to November 15, 2016, but ads for the dataset continued to be collected through calendar-year 2016. 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 survey responses from 155 institutions that reported seeking tenure-track faculty in 2017. Survey responses were dropped if the number of faculty positions being sought was zero or not specified. Multiple responses from the same institution were combined in cases that multiple searches from the institution led to multiple survey responses. 39 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 [1] as well as pertinent results reported in the 2016 Taulbee Survey of PhD-producing Computer Science departments [2]. Written-text feedback is included as appropriate.

3.1 Faculty Positions Being Sought

A summary of the faculty positions sought for the 155 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 [1], PhD-granting institutions are further classified into PhD100 and PhDOther using the U.S. News Rankings of the 100 Best Graduate schools[1].

Table 1: Summary of Faculty Positions Sought by Institution Type

Institution Type	Number of Institutions	Number of Positions Sought 1	2	3+	Total Positions
PhD100	35	6 (17%)	9 (26%)	20 (57%)	106
PhDOther	30	7 (23%)	12 (40%)	11 (37%)	76
MS	32	14 (44%)	12 (38%)	6 (19%)	61
BS	58	41 (71%)	13 (22%)	4 (7%)	80
All	155	68 (44%)	46 (30%)	41 (26%)	323

The table shows that 44% of all institutions responding to the survey were seeking to hire one tenure-track faculty member, 30% were seeking to hire two, and 26% were seeking to hire three or more tenure-track faculty members. Not surprisingly there is variation based on the type of institution with 71% of BS institutions reporting they sought to hire one faculty member while 57% of PhD100 institutions reported seeking to hire three or more.

The last column in Table 1 shows that the 155 institutions reported seeking to fill a total of 327 tenure-track faculty positions. The largest number (110) of these positions are for PhD100 institutions with MS institutions reporting the smallest number (61).

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 2017. 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 (Nov'16Ads) uses total positions for all institutions with ads placed by November 15, 2016, which were the set of ads used for the analysis of needs report [1]. The second set (2017Ads) uses total positions of ads for 2017 tenure-track positions placed by the end of 2016, 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 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 4-5% percent of the 2017Ads set.

Similarly the relative proportion of all positions for responding institutions are within 5% of all positions for the 2017Ads set. As described in [1] 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 27 of the 155 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 3.5 for the actual number of positions

[1] `http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-science-schools/computer-science-rankings`

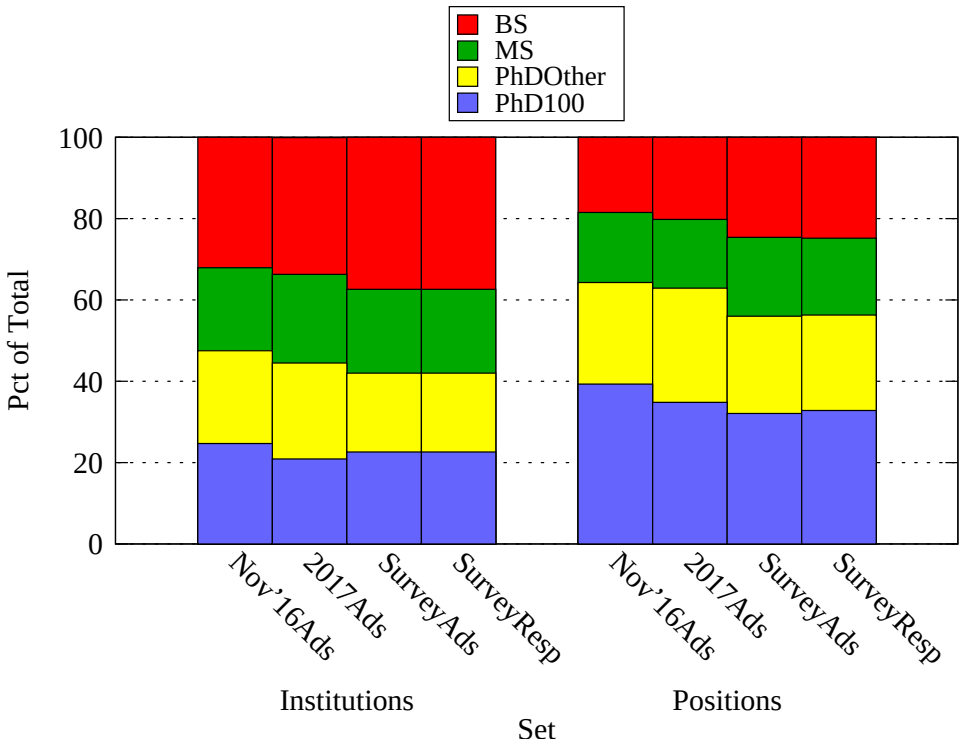

Figure 1: Comparison of Institution and Position Percentages by Institution Type

being sought. We also observe that the ads of the remaining 128 institutions indicated specific numbers of positions for a total of 188, yet the survey respondents for these institutions responded with a total of 227 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.

3.2 Positions Being Filled

Table 2 shows the number of tenure-track faculty positions filled based on the responses by the 155 institutions participating in the survey. The table shows these institutions reported filling a total of 244 positions with PhD100 institutions filling the most positions with 98 and MS institutions filling the least with 40.

Looking at the number of institutions filled by each institution we see 18% of all institutions had a "failed" search where no faculty positions were filled. 24% of BS institutions had failed searches. Not surprisingly, PhD100 institutions had the lowest proportion of failed searches (9%) and the highest proportion making three or more hires (46%).

Combining results in Tables 1 and 2, we determine an overall search success rate of 75% where 241 positions were filled out of a total of 323 positions being sought. As expected there is variation amongst institution type with PhD100 institutions having a 90% (95/106) success rate, PhDOther

Table 2: Summary of Positions Filled by Institution Type

Institution Type	Number of Institutions	Number of Positions Filled 0	1	2	3+	Total Positions
PhD100	35	3 (9%)	8 (23%)	8 (23%)	16 (46%)	95
PhDOther	30	5 (17%)	10 (33%)	10 (33%)	5 (17%)	51
MS	32	6 (19%)	16 (50%)	7 (22%)	3 (9%)	40
BS	58	14 (24%)	36 (62%)	5 (9%)	3 (5%)	55
All	155	28 (18%)	70 (45%)	30 (19%)	27 (17%)	241

having a 67% (51/76) success rate, MS having a 66% (40/61) rate, and BS having a 69% (55/80) success rate.

As comparison, Table F2 in the 2016 Taulbee Survey [2] presents similar aggregate search results for PhD-granting institutions in 2014-15. Those results report a tenure-track search success rate of 73% (304/418) for all U.S. Computer Science Departments. This success rate is lower than the combined success rate for PhD-granting (PhD100 and PhDOther) institutions of 80% (149/186) in our survey responses. One explanation for this difference is that a survey focused on faculty hiring may draw more responses for institutions that were successful.

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 155 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 18% of all searches for all types of institutions failed, 29% were less than successful, 46% of searches were a success and 7% were more than successful. Overall, 53% of institutions responding to the survey reported success or more in their search. The first grouping also shows that 28% of all single-position searches failed with the remaining 72% at least successful. Two-position searches failed for 17% of institutions and were at least successful for 37% of institutions. Finally, searches for three or more positions failed for 2% of institutions and were at least successful for 39% of institutions.

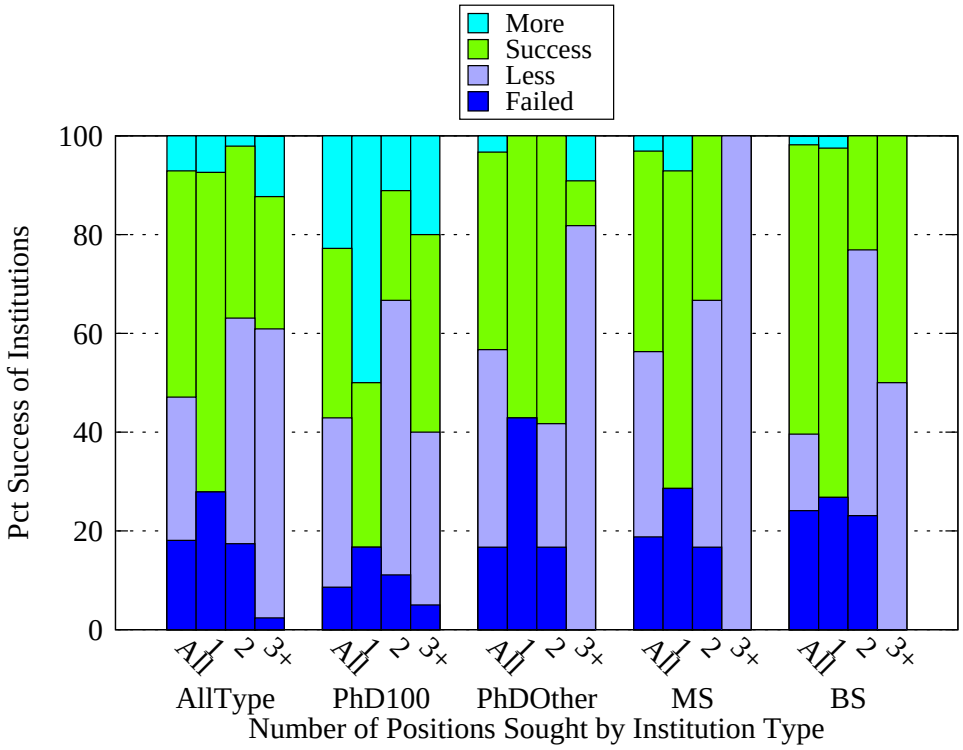

Figure 2: Percentages of Search Success by Institution Type

The remaining groupings in Figure 2 show the breakdown for each type of institution. Searches for all PhD100 institutions failed for 9% and were at least successful for 57%. Searches for all PhDOther institutions failed for 17% and were at least successful for 43%. Searches for all MS institutions failed for 19% and were at least successful for 44%. Searches for all BS institutions failed for 24% and were at least successful for 60%. These percentages indicate that BS and PhD100 institutions were the most successful in hiring at least as many tenure-track faculty as were being sought.

In comparison, the 2016 Taulbee Survey [2] only aggregates the number of faculty positions filled or unfilled, but does not provide per-institution results. However Table F2a in the report does provide reasons why positions are left unfilled with the top three being 43% due to offers turned down, 31% due to hiring in progress and 16% 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 institutions were less than successful. These reasons included a reduced number of applicants, lack of spousal accommodation, higher than expected salary requests, and increased competition for available candidates.

3.3 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 3 shows the proportion for each type of previous position for all institutions and each of the four institutional types. Previous positions are ordered based on numbers from most to least for all institutions. Note there are small inconsistencies in the total number of positions compared to Table 2 due to variations in survey responses for the number of filled positions for different questions.

Table 3: Summary of Previous Positions Held for Hired Faculty by Institution Type

Previous Position	All Types	Institution Type			
		PhD100	PhDOther	MS	BS
PhD	75 (31%)	28 (30%)	12 (23%)	15 (34%)	20 (38%)
PostDoc/Researcher	62 (26%)	31 (33%)	19 (36%)	8 (18%)	4 (8%)
T/TT	62 (26%)	29 (31%)	12 (23%)	11 (25%)	10 (19%)
NTT	20 (8%)	2 (2%)	4 (8%)	5 (11%)	9 (17%)
ABD	12 (5%)	0 (0%)	2 (4%)	4 (9%)	6 (12%)
NonAcad	10 (4%)	4 (4%)	2 (4%)	1 (2%)	3 (6%)
Other	2 (1%)	0 (0%)	2 (4%)	0 (0%)	0 (0%)
All	243 (100%)	94 (100%)	53 (100%)	44 (100%)	52 (100%)

The results show that 31% of all hired faculty start with a newly-earned PhD. 26% were previously in post-doc/researcher positions. 26% were previously in a tenured or tenure-track position at another institution. These were the three primary previous positions with the remaining options (non-tenure-track faculty, all-but-dissertation, non-academic and other) each less than 10%.

Results for different institution types showed some variation with post-doc/researcher positions the most prevalent previous position for PhD institutions. The most prevalent type of hire for MS and BS institutions was newly-awarded PhDs. There was more variation for the previous position of BS institution hires with 35% of tenure-track faculty positions at these institutions filled with hires who were previously on a non-tenure track, an all-but-dissertation student or a non-academic.

The 2016 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. Roughly a third of those losses are due to retirement and another third took academic positions elsewhere, which is the other side of the 25% of new hires in our survey results that came from a tenured/tenure-track at another institution. One survey respondent indicated they had hired new PhDs, but these faculty would not start until after a one-year post-doc position.

3.4 Areas in Which Faculty Were Hired

Our previous report on faculty hiring [1] clustered topics (which were called “areas” in that report) of interest into 18 areas (which were called “area clusters”). The term “area clusters” was used in a survey question, but for this report we simply call them “areas.” The table defining these areas and the constituent topics for each is reproduced in Table 4 from the previous report.

Table 4: Topics Grouped in Each Area

Area	Constituent Topics
AI/DM/ML	Artificial Intelligence, Computational Linguistics, Data Mining, Machine Learning, Natural Language Processing, Text Analytics
Arch	Architecture, Computer Organization
Bioinfo	Bioinformatics
Compiler/PL	Compilers, Programming Languages, Object-Oriented Languages
CompSci	Computational Biology, Computational Life Science, Computational Medicine, Computational Neuroscience, Computational Science, Neuroscience, Scientific Computation
DataSci	Big Data, Data Science, Data Analytics, Data Computation/Systems, Information Analysis, Knowledge Representation, Visualization, Visual Computing
DB	Database, Data Management, Information Retrieval, Information Systems
Games	Animation, Computational Media, Games, Interactive Media, Digital Media
HCI	Accessibility, HCI, Immersive Systems, Interactive Computing, Virtual Reality
ImageSci	Graphics, Image Processing, Pattern Recognition, Vision
Mobile	Human-Centered Computing, Mobile Systems, Ubiquitous/Pervasive Computing
Robotics/CPS	Autonomous/Vehicular Systems, Cyber-Physical Systems, Embedded Systems,Human-Centered Computing, Internet of Things, Reconfigurable Systems, Robotics, Sensors
Security	Cryptography, Forensics, Information Assurance, Privacy, Security
SoftEngr	Software Assurance, Software Design, Software Engineering, Software Systems
Sys/Net	Cloud Computing, Distributed Computing, High Performance Computing, Experimental Systems, Networking, Network Science, Operating Systems, Parallel Computing, Systems
Theory/Alg	Algorithms, Computational Complexity, Discrete Math, Foundations, Formal Methods, Logic, Theory
OtherCS	Applied Areas, Complex Systems, CS Education, Data Structures, Informatics, Information Technology, Intelligent Systems, Introductory CS, Modeling, Numerical Computation, Software, Social Computing, Social Networking, System Administration, System Design, System Verification, Web Technologies
OtherInter	Bioscience, Biomedical, Business Analytics, Cognitive Science, Communications, Economics, Energy Awareness, Geographic Information Systems, Green Computing, Health Informatics, Interdisciplinary, Learning Science, Medical, Social Computing, Sustainability, Urban Informatics

These 18 areas were used in [1] to analyze the topics of interest for hiring. These same areas were provided to survey respondents in this work to identify the area in which new faculty members were hired. We note that while a link to the report containing the areas and constituent topics was provided to respondents, additional information beyond the name of the area was not provided as part of the survey itself. See Appendix A for precise wording on this question.

Table 5 shows the numbers and percentages of hires for all types and each institution type based on the 155 institutions responding to the survey. Table rows are ordered based on the number of hires in each area (save for Other) with 52 hires in AI/DM/ML, which constitutes 21% of the 247 total positions. Again the total positions shown is slightly different than Tables 2 and 3 due to inconsistencies in survey responses.

Table 5: Summary of Areas for Hired Faculty by Institution Type

	All	Institution Type			
Area	Types	PhD100	PhDOther	MS	BS
AI/DM/ML	52 (21%)	22 (23%)	11 (20%)	9 (22%)	10 (18%)
Security	30 (12%)	13 (13%)	6 (11%)	4 (10%)	7 (13%)
Theory/Alg	20 (8%)	13 (13%)	1 (2%)	3 (7%)	3 (5%)
Sys/Net	19 (8%)	8 (8%)	3 (6%)	2 (5%)	6 (11%)
DataSci	18 (7%)	6 (6%)	6 (11%)	2 (5%)	4 (7%)
SoftEngr	16 (6%)	3 (3%)	6 (11%)	6 (15%)	1 (2%)
HCI	12 (5%)	2 (2%)	2 (4%)	2 (5%)	6 (11%)
CompSci	11 (4%)	2 (2%)	5 (9%)	2 (5%)	2 (4%)
Robotics/CPS	11 (4%)	5 (5%)	5 (9%)	0 (0%)	1 (2%)
Compiler/PL	8 (3%)	4 (4%)	2 (4%)	0 (0%)	2 (4%)
ImageSci	7 (3%)	4 (4%)	0 (0%)	2 (5%)	1 (2%)
Mobile	6 (2%)	4 (4%)	0 (0%)	1 (2%)	1 (2%)
Bioinfo	5 (2%)	3 (3%)	0 (0%)	1 (2%)	1 (2%)
Games	3 (1%)	1 (1%)	0 (0%)	1 (2%)	1 (2%)
Arch	2 (1%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)
DB	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
OtherCS	16 (6%)	3 (3%)	3 (6%)	5 (12%)	5 (9%)
OtherInter	11 (4%)	2 (2%)	4 (7%)	1 (2%)	4 (7%)
All	247 (100%)	97 (100%)	54 (100%)	41 (100%)	55 (100%)

The table shows that Security accounts for 30 (12%) of all filled positions with Theory/Alg accounting for 20 (8%) of filled positions. AI/DM/ML was the most popular area for all four institution types. Security was the second-most popular area for all types except MS, which had SoftEngr as second. Theory/Alg tied for second for PhD100 institutions. DataSci and SoftEngr tied for second for PhDOther institutions. It is worth noting that survey respondents did not report a single hire for a faculty member in the traditional area of Databases.

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 positions that were filled. This analysis was done by filtering the ads dataset to include only the 155 institutions that responded to the survey. We then repeated analysis that was done in [1] to

determine the percentage of positions sought in each of the 18 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 77% of the advertised positions, which is the same percentage as the 2017Ads dataset.

Figure 3 shows the results of scatter plotting each of the 18 areas based on their percentages of positions sought vs. positions filled for all 155 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.

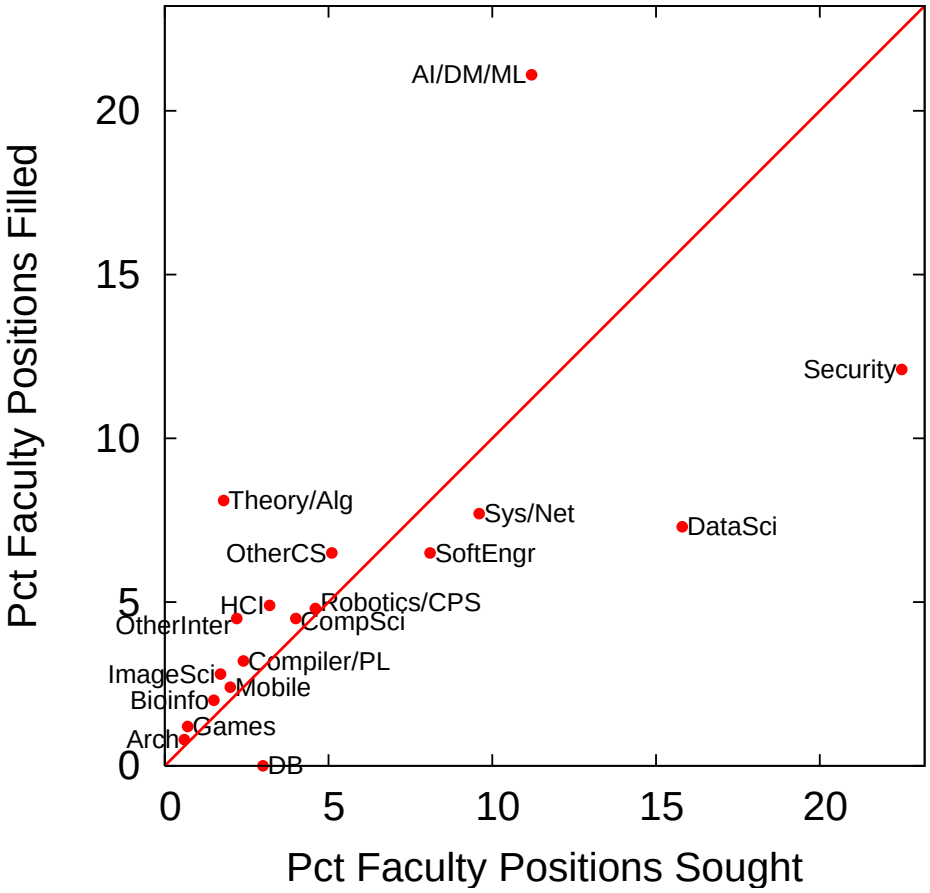

Figure 3: Percentages of Areas Sought vs. Areas Filled for All Institution Types

The most interesting areas in the figure are those furthest from the diagonal. The AI/DM/ML area is the most obvious above the diagonal with 21% of filled positions in this area, but 11% of sought positions. The Theory/Alg area is also plotted further above the diagonal with only 2% of positions sought in this area, but 8% of positions filled. On the other side of diagonal, Security was sought for 23% of positions, but only 12% of positions were filled in this area. Similarly DataSci

was sought for 16% of positions, but filled for only 7% of positions. DB was sought for 3% of positions, but not a single filled position was identified in this area.

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

1. A fraction (23%) 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.

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 4), but identified the hire in the survey as being in the area of AI/DM/ML. Along those lines we note that 27% of the positions sought were in either AI/DM/ML or DataSci and 28% of the positions filled were in either AI/DM/ML or DataSci. Thus further clustering of those two areas results in equilibrium for positions sought and filled.

Figure 4 repeats the same analysis after dividing all institutions into PhD-granting (PhD100 and PhDOther) and non-PhD-granting (MS and BS) institutions. As reference, results in Table 2 show that roughly 60% of filled positions were done so by PhD-granting institutions.

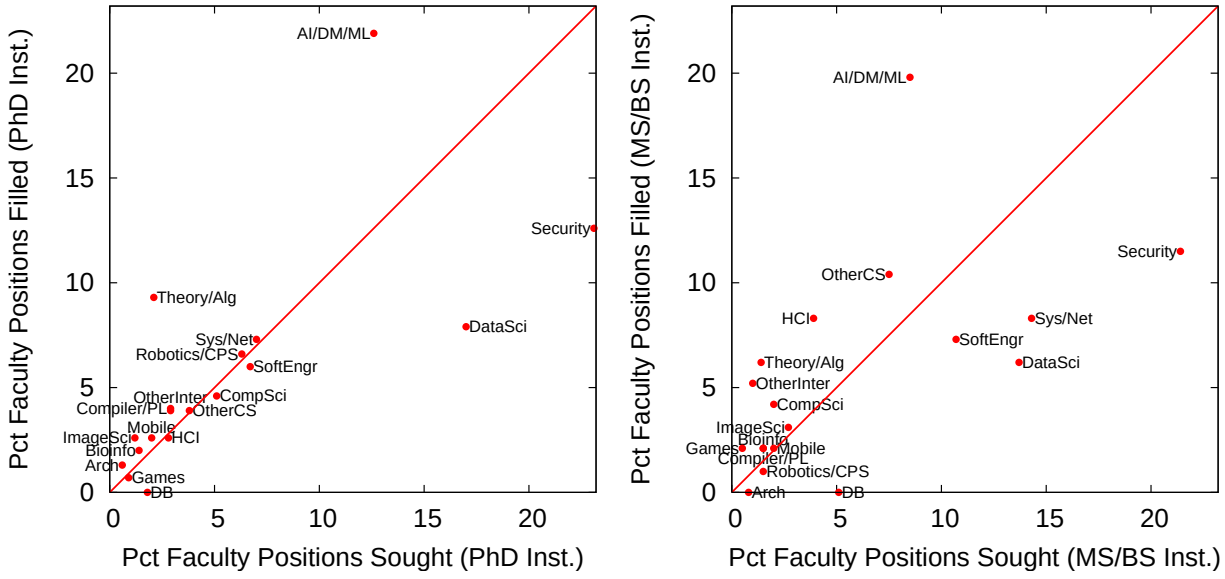

Figure 4: Percentages of Areas Sought vs. Areas Filled for PhD and MS/BS Institutions

The plot on the left for PhD institutions largely mimics the results shown in Figure 3. However the plot on the right for MS and BS institutions exhibits some differences. There is a net percentage difference of 11% for AI/DM/ML and a smaller net difference of 5% for Theory/Alg, but also a

4% difference for HCI and OtherInter areas. These are areas above the diagonal in which a higher percentage of positions were filled than sought. In terms of areas below the diagonal (higher percentage of positions sought than filled), Security, at a net difference of 10%, and DataSci at 8% also had the largest differences, but Sys/Net (6%), DB (5%) and SoftEngr (3%) also had larger net differences.

3.5 Faculty Hiring and PhD Production

The 2016 Taulbee Survey [2] 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 2016 data are one year removed from the 2017 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 regardless of their subsequent employment. Table 6 shows the number (and percentage) sorted in decreasing order for each specialty as given in [2]. Little additional explanation for the content of each specialty beyond the name is provided in the text of that report. The text indicates that the "Artificial Intelligence" specialty includes Machine Learning and the Other category also includes unknown responses.

Table 6: 2016 Taulbee Survey New PhD by Specialty

Specialty	Cnt (%)	Corresponding Area
Artificial Intelligence	256 (14%)	AI/DM/ML
Software Engineering	131 (7%)	SoftEngr
Database/Information Retrieval	111 (6%)	DB
Security/Information Assurance	106 (6%)	Security
Networks	102 (5%)	Sys/Net
Theory and Algorithms	98 (5%)	Theory/Alg
Graphics/Visualization	94 (5%)	ImageSci
Robotics/Vision	77 (4%)	Robotics/CPS
Informatics: Biomedical/Other Science	71 (4%)	
Hardware/Architecture	67 (4%)	Arch
Programming Languages/Compilers	63 (3%)	Compiler/PL
High-Performance Computing	61 (3%)	Sys/Net
Operating Systems	56 (3%)	Sys/Net
Human-Computer Interaction	47 (2%)	HCI
Information Science	42 (2%)	
Social Computing/Social Informatics	28 (1%)	
Scientific/Numerical Computing	25 (1%)	CompSci
Information Systems	23 (1%)	
Computing Education	19 (1%)	
Other	411 (22%)	
Total	1888 (100%)	

The last column in Table 6 shows the corresponding area from Table 4 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 4 are associated with a specialty in Table 6.

The two graphs in Figure 5 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 3). The 12 areas most clearly corresponding to specialties in Table 6 are shown in each graph.

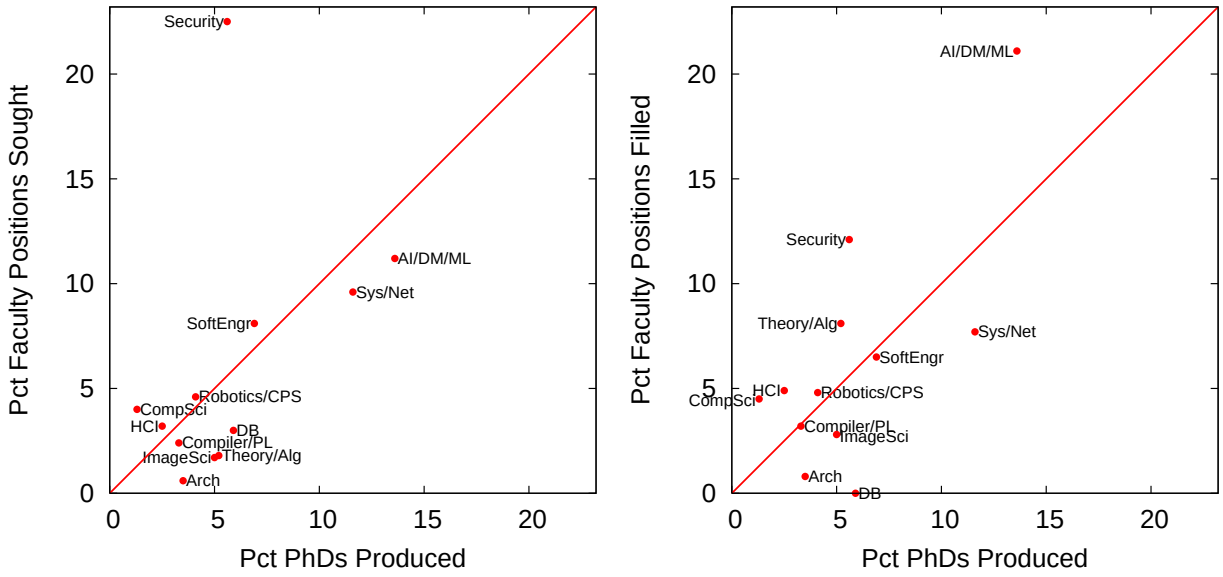

Figure 5: Percentages of Areas of PhDs Produced vs. Areas Sought/Filled for All Institution Types

In the left graph of Figure 5, Security is the area with most obvious discrepancy between percentage of PhDs produced (6%) and faculty positions sought (23%). Note that DataSci, the second-most sought area, is not included because there is no corresponding specialty in Table 6. Most areas are relatively close to the diagonal indicating similar percentages of PhDs produced and positions sought. The areas of Theory/Alg, ImageSci and Arch each have approximately 3% lower net percentage of positions sought than PhDs produced.

In the right graph of Figure 5, AI/DM/ML and Security are the areas with the highest discrepancy between PhDs produced and positions filled with a net of 8% and 7% more positions filled. CompSci and Theory/Alg each have roughly a 3% net percentage more of positions filled than PhDs produced. On the other side of the diagonal, DB (6%), Sys/Net (4%) and Arch (3%) have a higher net percentage of PhDs produced 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 2017. 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. The primary tool used for this work was a survey.

An email message with a link for the survey was sent to a search contact at 443 institutions. Survey responses were obtained from 155 institutions that reported seeking tenure-track faculty in 2017. 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 323 faculty positions.

Survey respondents reported filling a total of 241 tenure-track faculty for an aggregate success rate of 75%. Examination on the success of the search for each of the 155 institutions found that 18% of institutions failed to hire any faculty, while 53% succeeded in hiring at least as many faculty as were being sought. The Top-100 PhD institutions had the smallest failed search rate of 9% while BS institutions had the highest failed search rate of 24%. Top-100 (57%) and BS (60%) institutions had the highest rate of hiring at least as many faculty as were being sought.

Reported results on the previous position for hired faculty show that three types of such positions predominant. 31% of hired faculty start with a newly-earned PhD, 26% were previously in a post-doc/researcher position, and 26% were previously in a tenured or tenure-track position at another institution.

Survey respondents reported on the number of hires in each of 18 clustered areas. The clustered area of AI, Data Mining and Machine Learning accounted for 21% of the filled positions. Security accounted for the next most with 12% of the filled positions and Theory/Algorithms was third with 8% of filled positions. Not a single hire was reported in the traditional area of Databases.

In comparing the areas of filled positions with the areas in which positions were sought, the AI/DM/ML area showed the biggest positive difference with 21% of filled positions, but only 11% of sought positions. The Theory/Alg area showed the second biggest positive net percentage difference of 6% between percentage of positions filled and sought. In contrast, the area of Security showed the biggest negative difference with 12% of filled positions, but 23% of sought positions. The area of DataSci had a 9% negative net percentage difference between filled and sought positions. One explanation for the difference in percentages filled vs. sought is advertising with language for one area, but reporting the filled position in another area. For example, combining the AI/DM/ML and DataSci areas into one area results in 28% of the filled and 27% of the sought 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 (23%). AI/DM/ML and Security are the areas with the highest discrepancy between PhDs produced and positions filled with a net of 8% and 7% more positions filled than PhDs produced.

In summary, the results show a mix of success with just over 50% of institutions hiring at least the number of faculty they were seeking. In terms of areas, AI/DM/ML and Data Science collectively represent 28% of positions filled, although PhD production in these areas was not this high. There was much stronger demand for positions in Security than PhD production or positions actually filled.

A direction for future work is incorporate feedback on improvements in 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 the acknowledge the 155 institutions that responded to the survey. 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. Analysis of current and future computer science needs via advertised faculty searches for 2017. *Computing Research News*, 29(1), January 2017. See technical report for details of study.
`http://cra.org/crn/2017/01/analysis-current-future-computer-science-needs-via-advertised-faculty-searches-2017/`
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[2] Stuart Zweben and Betsy Bizot. 2016 Taulbee Survey. *Computing Research News*, 29(5), May 2017.
`http://cra.org/crn/wp-content/uploads/sites/7/2017/05/2016-Taulbee-Survey.pdf`.

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 2017. 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. 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 to begin in 2017?

Q3 How many tenured/tenure-track faculty have you hired to begin in 2017?

Q4 How many tenure/tenure-track faculty were hired in each of these area clusters (total across all areas should reflect the total number of hired faculty)?

AI/Data Mining/Machine Learning
Architecture
Bioinformatics
Compilers/Prog Languages
Computational Science
Data Science
Databases
Games
Human Computer Interaction
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 2017. 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-Q6.]