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## A PORTRAYAL OF IRANIAN-AMERICAN INVENTORS: A PATENT PERSPECTIVE

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### I. INTRODUCTION

There have been several attempts to characterize socioeconomic characteristics of the Iranian-American community.<sup>1</sup> These studies, however, are often based on data collected by the 2000 U.S. Census, which many believe grossly underestimate the number of Iranian-Americans in the United States.<sup>2</sup> Other attempts to describe the Iranian-American community can be, at best, characterized as ad-hoc efforts that provide an incomplete and subjective portrayal of the community based on unreliable sources. For example, certain Wikipedia pages include listings of prominent Iranian-Americans.<sup>3</sup> However, it is difficult to verify the accuracy of such claims since many have been produced based on the input from the users of the website themselves. In addition, it is difficult to assess the collective impact of such individuals on the greater U.S. community.

This paper provides an objective assessment of the Iranian-American contributions to United States science and technology as measured by their inventions registered with the United States Patent and Trademark Office (USPTO). While the results presented here relate to only a narrow facet of the Iranian-American community, they can be used along with other measures to more accurately characterize the Iranian-American community as a

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<sup>1</sup> Ali Mostashari and Ali Khodamhosseini, *An Overview of Socioeconomic Characteristics of The Iranian-American Community Based on the 2000 U.S. Census*, Iranian Studies Group at MIT, (Feb. 2004), <http://www.isgmit.org/research/?id=279&cat=iranian-american&stat=full>; Shirin Hakimzadeh and David Dixon, *Spotlight on the Iranian Foreign Born*, Migration Information Resource, (Jun. 2006), <http://www.migrationinformation.org/Usfocus/display.cfm?ID=404>.

<sup>2</sup> Hakimzadeh & Dixon, *supra* note 2.

<sup>3</sup> List of Iranian Americans, [http://en.wikipedia.org/wiki/List\\_of\\_Iranian\\_Americans](http://en.wikipedia.org/wiki/List_of_Iranian_Americans) (last visited May 23, 2010); List of contemporary Iranian scientists, scholars, and engineers, [http://en.wikipedia.org/wiki/List\\_of\\_contemporary\\_Iranian\\_scientists](http://en.wikipedia.org/wiki/List_of_contemporary_Iranian_scientists) (last visited May 23, 2010).

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whole. Section II of this paper provides a brief background of the Iranian-American community and Section III describes procedures and general statistics associated with United States patents. In Section IV, a few well-known Iranian-American innovators are introduced. Section V describes the methodology used in this paper to identify the Iranian-American inventors and presents some of the statistics associated with these inventors. Concluding remarks and future considerations are presented in Section VI.

## II. OVERVIEW OF IRANIAN-AMERICAN POPULATION

The first wave of Iranian immigration to the United States started in the mid-1950s, which primarily consisted of college students, who were studying abroad in order to meet the needs of the rapidly industrializing oil-based Iranian economy.<sup>4</sup> A larger wave of Iranian immigration to the United States occurred from around the time of the Islamic Revolution in 1979 to the present. The population of Iranian-Americans reached an estimated 300,000 to 350,000 in the year 2000 according to Census Bureau statistics.<sup>5</sup> Many believe, however, that the total number of Iranian-Americans is much larger than what Census Bureau figures suggest.<sup>6</sup> Nonetheless, the 2000 Census data is currently the best available source of demographic information for Iranian-Americans.

Aside from the raw population numbers, other statistics associated with the 2000 Census can provide a general portrayal of the Iranian-American community. For example, according to the 2000 Census statistics, over 50% of the Iranian-Americans hold a bachelor's degree or higher [level of education].<sup>7</sup> The 2000 census data also indicates that more than 25% of Iranian-Americans hold masters or doctoral degrees, and about one-third work in professional, scientific, educational and information-related industries.<sup>8</sup> The Census data also estimates median family income and per capita incomes of approximately \$70,000 and \$30,000, respectively, which are higher than the respective US median family and per capita incomes of about \$50,000 and \$22,000, respectively.<sup>9</sup>

Iranian-American males over 15 years of age outnumber their female counterparts according to a 55%-to-45% ratio.<sup>10</sup> The male population also appears to be more educated, as 66% of males hold at least a bachelor's degree compared to about 45% of females.<sup>11</sup> This discrepancy becomes larger at higher education levels. For example, 7.1% of Iranian-American males hold Doctorate degrees compared to 2.6% of Iranian-American females.<sup>12</sup>

The above statistics provide an overall assessment of income, education and gender characteristics of the Iranian-American community but they fail to measure the contributions of the Iranian-Americans to the

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<sup>4</sup> Hakimzadeh & Dixon, *supra* note 2.

<sup>5</sup> *See supra* note 2.

<sup>6</sup> Hakimzadeh & Dixon, *supra* note 2.

<sup>7</sup> *See supra* note 2.

<sup>8</sup> Mostashari & Khodamhosseini, *supra* note 2.

<sup>9</sup> *Id.*

<sup>10</sup> *Id.*

<sup>11</sup> *Id.*

<sup>12</sup> *Id.*



US society in any specific way.<sup>13</sup> The remainder of this paper is devoted to presenting a narrow, but reliable, assessment of the Iranian-Americans community in terms of their contributions to U.S. science and technology. This assessment is based on the number of U.S. patents issued to Iranian-American inventors. Since the United States Patent and Trademark Office (USPTO) database is used as the source of raw information, the reliability of presented statistics is extremely high. However, since the USPTO database fails to indicate who is, and who is not, an Iranian-American, one of the main challenges faced by the author was identifying inventors of Iranian descent. This issue is tackled in Section V of this paper, where a large number of Iranian-American inventors are identified.

### III. UNITED STATES PATENTS

According to the United States Code “[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”<sup>14</sup> A patent gives its owner an exclusive right to exclude others from making, using, or selling the invention as defined in the claims of the patent for a period of time, which in the United States is 20 years from the date of filing the patent application.<sup>15</sup> Therefore, a patent gives its owners a limited period of exclusivity in exchange for public disclosure of the invention.

Filing a patent application involves writing a detailed “specification” and providing the associated drawings, which fully and concisely describe the invention such that it can be understood by a person of ordinary skill in the art.<sup>16</sup> The patent application also includes a set of “claims,” which particularly point out and distinctly claim the subject matter which the applicant regards as his invention.<sup>17</sup> In other words, the claims “define the metes and bounds of the subject matter that will be protected by the patent grant.”<sup>18</sup> Once filed, the patent application undergoes extensive examination at the USPTO that usually lasts between two to five years. During this period, the USPTO evaluates the patent application to determine if, among other considerations, the claims of the application are directed to patentable subject matter<sup>19</sup>, are novel<sup>20</sup>, and are non-obvious<sup>21</sup> over the existing systems or publicly available publications.

Due to the complex nature of writing and prosecuting patent applications, as well as nuanced changes that are continually interjected into the U.S. patent laws through different court decisions, drafting and prosecuting patent applications are usually carried out by Patent Attorneys or experienced registered

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<sup>13</sup> Income level statistics arguably provide a measure of contribution to the U.S. economy since they can be correlated to the spending power, and perhaps the income tax paid to the U.S. Treasury. However, the census statistics are compiled from data that is voluntarily provided by the participants, which is never verified or corroborated by supporting evidence. Therefore, the reported income levels may not be completely trustworthy.

<sup>14</sup> 35 U.S.C. § 101 (2008).

<sup>15</sup> 35 U.S.C. § 154(a) (2008).

<sup>16</sup> 37 C.F.R. § 1.71; Manual of Patent Examining Procedure (MPEP) § 608.01 (2008).

<sup>17</sup> MPEP § 608.01(i).

<sup>18</sup> 35 U.S.C. § 112 (2008).

<sup>19</sup> 35 U.S.C. § 101.

<sup>20</sup> 35 U.S.C. § 102 (2008).

<sup>21</sup> 35 U.S.C. § 103 (2008).



patent agents. Once granted, a patentee can use the patent to exclude others from using, making or selling the patented invention.<sup>22</sup> Many patent owners use this opportunity to file patent infringement lawsuits against competitors' products that infringe their patented inventions. Such lawsuits have sometimes resulted in lucrative settlements or significant verdicts in the range of several hundreds of million dollars.<sup>23</sup> In other scenarios, having a large patent portfolio positions a corporation to better defend against infringement lawsuits that are brought against them by other corporations or individuals. In such cases, the patent holder may use their existing patent portfolio to initiate counterclaims against the plaintiff, or to facilitate settlement negotiations by, for example, cross-licensing the patents.

A study conducted on behalf of the European Commission has found that, on average, a patent in EU-8 countries is worth about 3 million Euros.<sup>24</sup> However, such average values may be skewed upwards by a small number of very valuable patents. In the United States, some consider innovation as one of the major driving forces behind the overall U.S. economy.<sup>25</sup> A recent white paper from the U.S. Department of Commerce also suggests that innovations and high-valued patents produce high-paying jobs and fuel economic growth.<sup>26</sup> But, clearly, not all patents are valued the same. In some cases, an issued patent may be invalidated through subsequent challenges that are brought against it during the course of patent infringement lawsuits and/or re-examination proceedings at the USPTO. In other cases, patents that are drafted to cover a very narrow range of products become useless against a competitor's products that have been devised to work around the narrowly-drafted patent claims. The topic of patent valuation is very complex and depends on factors, such as the technical field of the patent, the demand for the patented technology, and many other considerations that are outside of the scope of this paper.<sup>27</sup>

The strategic importance of patents is supported by the ever increasing number of U.S. patent applications that are filed by U.S. and foreign corporations and individuals. Figure 1 illustrates the number of patent

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<sup>22</sup> 35 U.S.C. § 154(a).

<sup>23</sup> See, e.g., *Polaroid Corp. v. Eastman Kodak Co.*, 16 U.S.P.Q.2d 1481 (D. Mass. 1990) (holding that Eastman Kodak was liable for \$925,000,000 to be paid to Polaroid Corporation); *City of Hope National Medical Center v. Genentech, Inc.*, 43 Cal. 4th 375 (2008) (upholding a \$300 million jury verdict for breach of contract in favor of City of Hope National Medical Center).

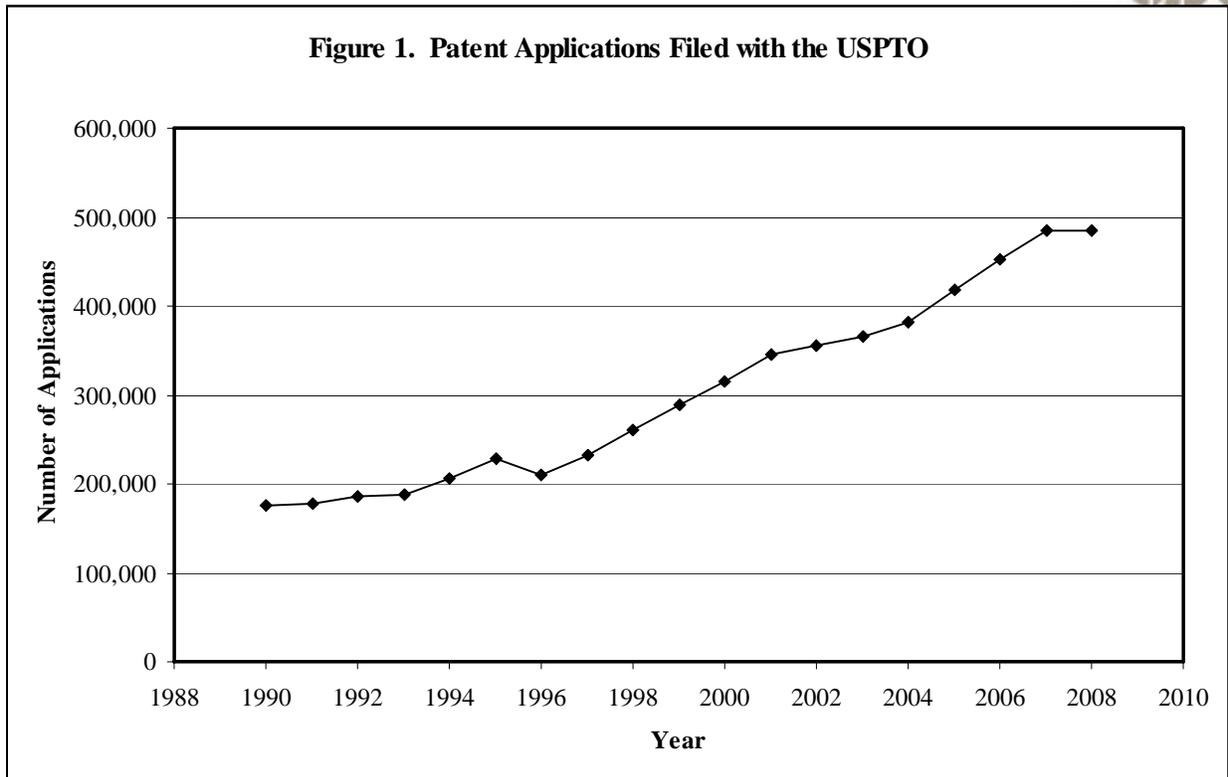
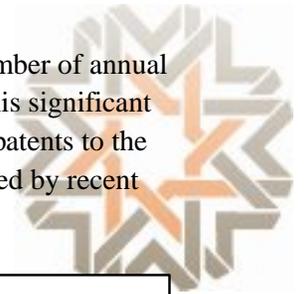
<sup>24</sup> EU-8 countries referred to in the European Commission study include Hungary, United Kingdom, Estonia, Germany, Denmark, Italy, France and Netherlands. See European Commission, "Study on evaluating the knowledge economy what are patents actually worth?" Tender n° MARKT/2004/09/E, Lot 2, FINAL REPORT (Jul. 23, 2006), [http://ec.europa.eu/internal\\_market/indprop/docs/patent/studies/final\\_report\\_lot2\\_en.pdf](http://ec.europa.eu/internal_market/indprop/docs/patent/studies/final_report_lot2_en.pdf).

<sup>25</sup> Under the economic doctrine of Innovation Economics, knowledge, technology, entrepreneurship and innovation are positioned at the center of the economic model in which smart public-private partnerships are envisioned to spur higher productivity and greater innovation. See The Information Technology and Innovation Foundation resources webpage, <http://www.innovationeconomics.org/resources/2/innovation-economics-resources> (last visited May 23, 2010).

<sup>26</sup> Rai *et al.*, U.S. Department of Commerce, Patent Reform, Unleashing Innovation, Promoting Economic Growth & Producing High-Paying Jobs (2010), <http://www.commerce.gov/news/fact-sheets/2010/04/20/white-paper-patent-reform-unleashing-innovation-promoting-economic-growth>.

<sup>27</sup> Ian Cockburn, Assessing the Value of a Patent: Things to Bear in Mind, [http://www.wipo.int/sme/en/documents/valuing\\_patents.htm#worth](http://www.wipo.int/sme/en/documents/valuing_patents.htm#worth) (last visited May 23, 2010).

applications filed with the USPTO from 1990 to 2008.<sup>28</sup> As evident from Figure 1, the number of annual filings has increased from about 176,000 applications in 1990 to over 485,000 in 2008. This significant increase in the number of patent filings is likely indicative of the importance and value of patents to the corporate and individual patent owners, as well as an increase in innovations that are spurred by recent advancements in high-technology fields.



Before delving into the topic of Iranian-American patent holders, it is instructive to note that not all innovations are patented. For example, some innovations are kept as trade secrets. One of the best known examples relates to Coca Cola Company's formula for its soft drink, which is a closely held trade secret known only to a few employee executives.<sup>29</sup> Others innovators forgo the time and expense associated with filing, prosecuting and maintaining patents, and simply decide to bring their products directly to the market. Certain other innovations are developed for non-profit or academic purposes and are therefore never patented. In some cases, innovative products are developed out in the public domain as a result of the cooperation of many individuals, which forecloses the patenting possibility. The open source project is an example of the latter.<sup>30</sup>

#### IV. IRANIAN-AMERICAN INNOVATORS

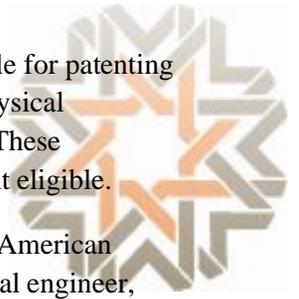
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<sup>28</sup> U.S. Patent and Trademark Office (USPTO), U.S. Patent Statistics Chart Calendar Years 1963 – 2009, [http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us\\_stat.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm) (last visited May 23, 2010).

<sup>29</sup> Mark Pendergrast, *For God, Country & Coca-Cola*, 456 (2nd ed. 2000).

<sup>30</sup> See Open Source Initiative, <http://opensource.org/history> (last visited May 23, 2010).

Another important class of innovations relate to fundamental discoveries that are not eligible for patenting under the US Patent Laws upon their initial discovery. For example, the laws of nature, physical phenomena and abstract ideas have been consistently construed as not being patentable.<sup>31</sup> These fundamental discoveries, however, often lead to new and innovative products that are patent eligible.



The story of Dr. Lotfi A. Zadeh is one example of a fundamental discovery by this Iranian-American inventor that cannot be quantified in terms of patents. Dr. Zadeh, a mathematician, electrical engineer, computer scientist, and a professor of computer science is known as the father of fuzzy logic. Born in Baku, Azerbaijan, to an Iranian father and a Russian mother, Dr. Zadeh grew up in Iran, where he attended Alborz High School, one the premier high schools in Iran.<sup>32</sup> After placing second in the nationwide university entrance exam, Dr. Zadeh attended Tehran University and graduated with a degree in electrical engineering in 1942.<sup>33</sup> Dr. Zadeh then moved to the United States in 1944.<sup>34</sup> He received an MS degree in electrical engineering from MIT in 1946, and a PhD in electrical engineering from Columbia University in 1949.<sup>35</sup>

Dr. Zadeh taught for ten years at Columbia University, and has taught at the University of California, Berkeley since 1959. He published his seminal work on fuzzy sets in 1965, in which he detailed the mathematics of fuzzy set theory. In 1973 he proposed his theory of fuzzy logic. Dr. Zadeh's most recent recognition comes from The Franklin Institute in Philadelphia for inventing and developing the field of “fuzzy logic,” in which a system applies a quantitative assessment to inherently ambiguous ideas, thus providing a new paradigm to improve artificial intelligence and automated control systems.<sup>36</sup> Today, almost all consumer products, among them cameras, washing machines, microwaves and automobiles, employ fuzzy logic in one form or another.<sup>37</sup> The impact of fuzzy logic can be felt within the basic sciences, the applied sciences and engineering.

The impact of fuzzy logic is evidenced by over 58,000 scientific publications that contain the word “fuzzy” in their titles and at least 10 science and engineering journals that carry the name “fuzzy” in their titles.<sup>38</sup> Furthermore, over 4,800 Japanese patents and 1,700 U.S. patents have issued in the area of fuzzy logic.<sup>39</sup> As the “father of fuzzy logic,” Dr. Zadeh has received his share of accolades, including over 30

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<sup>31</sup> *Diamond v. Chakrabarty*, 447 U.S. 303, 206 USPQ 193 (1980).

<sup>32</sup> Lotfi Asker Zadeh Biography, World of Computer Science, <http://www.bookrags.com/biography/lotfi-asker-zadeh-wcs/> (last visited May 23, 2010).

<sup>33</sup> *Id.*

<sup>34</sup> *Id.*

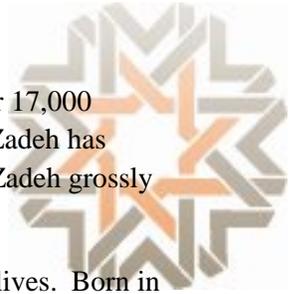
<sup>35</sup> *Id.*

<sup>36</sup> The Berkeley Initiative in Soft Computing (BISC) News, Electrical Engineering and Computer Sciences Department, University of California Berkeley, <http://www-bisc.cs.berkeley.edu/> (last visited May 23, 2010).

<sup>37</sup> Welcome to BISC Program, Electrical Engineering and Computer Sciences Department, University of California Berkeley, <http://www.cs.berkeley.edu/~zadeh/suprco.html> (last visited May 23, 2010).

<sup>38</sup> Statistics on the Impact of Fuzzy Logic, , Electrical Engineering and Computer Sciences Department, University of California Berkeley, <http://www.cs.berkeley.edu/~zadeh/stimfl.html> (last visited May 23, 2010).

<sup>39</sup> *Id.*



prestigious awards.<sup>40</sup> He has also authored numerous publications and there are also over 17,000 publications that reference his papers.<sup>41</sup> In terms of registered inventions, however, Dr. Zadeh has received only two US patents.<sup>42</sup> Obviously, the number of patents that are issued to Dr. Zadeh grossly understates his contributions to science and technology.

Dr. Ali Javan is another Iranian-American whose innovations have greatly impacted our lives. Born in Tehran, Dr. Javan attended the University of Tehran and then the Columbia University after coming to the United States in 1948.<sup>43</sup> He received his Ph.D. in physics in 1954 and became a researcher at Bell Labs, where he first proposed the principles of gas lasers.<sup>44</sup> In 1961, Dr. Javan joined Massachusetts Institute of Technology (MIT) as an associate professor in physics, where he continues to work as a professor emeritus.<sup>45</sup>

In 1960, Dr. Javan received U.S. patent 3,149,290, titled “Gas Optical Maser,” together with William Bennett. The patent described a gas laser, and in particular a Helium-Neon (HeNe) laser, for the first time. The gas laser has had a great impact on our lives. For instance, laser telecommunication via fiber optics is known to be the key technology used in today's Internet.<sup>46</sup> Gas lasers are also used in holography, precision measurement instruments, medical applications and other applications that impact our everyday lives.<sup>47</sup> As a member of MIT faculty, Dr. Javan has continued to make valuable contributions to the field of laser physics since his initial invention in 1960.<sup>48</sup> Dr. Javan is the co-inventor of about 30 issued US patents.<sup>49</sup> The impact of Dr. Javan’s inventions, however, are considerably higher than these numbers indicate. A search of the USPTO database indicates that, since 1976, over 1800 issued patents include the words “gas laser” or “Helium Neon laser” in at least one of their claims.<sup>50</sup>

As the above examples illustrate, the number of granted patents does not necessarily correlate with the significance of a person’s contributions to the science and engineering. This used to be particularly true

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<sup>40</sup> Awards, Memberships, Honors and Fellowships, Electrical Engineering and Computer Sciences Department, University of California Berkeley, <http://www.cs.berkeley.edu/~zadeh/awfeho.html> (last visited May 23, 2010).

<sup>41</sup> See Statistics on Impact of Fuzzy Logic, *supra* note 39; Awards, Memberships, Honors and Fellowships, *supra* note 41.

<sup>42</sup> Both patents were issued in 1956. See Patents - Lotfi Zadeh, Electrical Engineering and Computer Sciences Department, University of California Berkeley, <http://www.eecs.berkeley.edu/Pubs/Patents/Faculty/zadeh.html> (last visited May 23, 2010).

<sup>43</sup> Mary Bellis, Ali Javan – The Gas Laser, [http://inventors.about.com/od/ijstartinventors/p/Ali\\_Javan.htm](http://inventors.about.com/od/ijstartinventors/p/Ali_Javan.htm) (last visited May 23, 2010).

<sup>44</sup> *Id.*

<sup>45</sup> *Id.*

<sup>46</sup> *Id.*

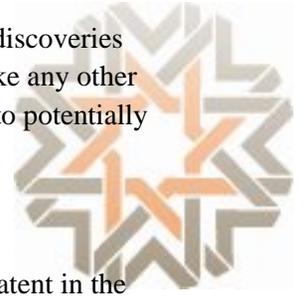
<sup>47</sup> See Gas Lasers, Encyclopedia of Laser Physics and Technology, [http://www.rp-photonics.com/gas\\_lasers.html](http://www.rp-photonics.com/gas_lasers.html) (last visited May 23, 2010).

<sup>48</sup> Biographical Sketch, <http://alijavan.mit.edu/WPP61Bio.htm> (last visited May 23, 2010).

<sup>49</sup> The patent search utility “freepatentsonline.com” was used to conduct this search. See <http://www.freepatentsonline.com/> (last visited May 23, 2010).

<sup>50</sup> USPTO database allows keyword searches for patents that are issued since 1976. See USPTO, Patent Full-text and Full-Page Image Database, <http://patft.uspto.gov/> (last visited May 23, 2010). Thus, the total number of patents, which includes pre-1976 patents, is likely considerably higher than 1800.

for academicians that were likely to publish their findings as research articles before their discoveries could be implemented as part of patentable applications. However, today's universities, like any other research and development organization, have started transforming scientific discoveries into potentially lucrative patents.<sup>51</sup>



## V- IRANIAN AMERICAN PATENT HOLDERS

Distinguishing American inventors of Iranian origin is a difficult task. When filing for a patent in the United States, the inventors' ethnicity or national origin are not collected by the USPTO. The US Patent Office periodically releases certain information about the number of foreign- and US-based patents that are based on the residence of the first-named inventors.<sup>52</sup> These statistics, however do not reveal the ethnicity of the patentees. One way to distinguish Iranian-American inventors is to examine the inventor names for each issued U.S. patent to determine if it appears to be of Iranian origin. This task requires a comprehensive list of Iranian names, which can then be compared against a listing of US patent holders. The sections that follow describe the methodology for conducting such a search and the statistics that were produced as a result of applying that methodology.

### *A - Methodology*

The first task was to produce a listing of names with Iranian origin. Since compilation of an exhaustive list is not feasible, a partial list was produced that included certain common Iranian first and last names, as well as a few Iranian last name suffixes. Some of the names were obtained from a website that provides a listing of Iranian first names.<sup>53</sup>

One of the challenges associated with producing such a list is that a large number of Iranians have first or last names with Arabic origin. For example, "Ali" is a common Iranian first name which is also popular among males of other Muslim countries. To avoid overestimating the number of Iranian-American inventors, first names with Arabic origin were eliminated from the list.<sup>54</sup> Similarly, certain last names with Arabic origin were eliminated from the list. The same approach was used to exclude certain other first names, such as Roksana, Nader, Tara and others. These names, while commonly used by Iranians, also appear widely in non-Iranian communities. The list of names was then expanded to include a number of prominent Iranian-American researchers and scientists.<sup>55</sup> The list was also augmented by the names of several researchers and inventors with whom the author is personally acquainted.

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<sup>51</sup> See Tom Coupé, *Academic R&D and University Patents*, 28 (no. 1), *J. TECH. Transfer*, 1573 (2003), available at <http://ftp.vub.ac.be/~tcoupe/patents1.pdf>.

<sup>52</sup> See USPTO, *Extended Year Set - All Technologies (Utility Patents) Report*, [http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h\\_at.htm#Desc](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_at.htm#Desc) (last visited May 23, 2010).

<sup>53</sup> See *Persian/Iranian/Farsi Names*, <http://www.iranians.name/> (last visited May 23, 2010).

<sup>54</sup> One exception included the first name "Reza," which after searching the USPTO database, produced a large, but manageable, number of matches. The matches were then individually analyzed to exclude inventors with non-Iranian names.

<sup>55</sup> See *The Iranians*, <http://www.parstimes.com/Iranians.html> (last visited May 23, 2010); List of contemporary Iranian scientists, *supra* note 4.



The list was used to search the USPTO website using the “Advanced Search” option.<sup>56</sup> The search was conducted based on the names that appeared on the assembled list of Iranian names, while limiting the inventors’ residences to within one of the 50 states. Due to the large number of names and the limitations of the USPTO website, the list of names was broken up into several smaller lists and multiple iterations of the search were conducted. In some cases, especially in search iterations that involved a listing of last names, the search results were further verified, one patent at a time, to manually look for and exclude patents with non-Iranian-American inventors.<sup>57</sup> The verification process revealed very few errors.

As a result of multiple search iterations, a large number of patent numbers were obtained, which were then filtered to remove duplicates. The final tally included over 14,000 patents that were issued from 1976 to early 2010 to Iranian-American inventors. The author believes the true number of patents issued to Iranian-American inventors is certainly higher than what is reported in this study since it is close to impossible to account for every name with Iranian origin, given the diversity of Iranian names and the variations in spellings of many names. Also, as noted above, a large number of Iranian names with Arabic origin were discarded. In addition, the current methodology fails to identify some Iranian-American inventors who have changed, or shortened, their first, and perhaps their last names. As a result, the results that are presented in this paper provide a conservative, but reliable, baseline of the number of patents granted to Iranian-American inventors.

Obtaining such a listing of patent numbers was only part of the objective. The list of patent numbers was subsequently used to obtain the various statistics that are presented in the next section. These statistics were collected using additional data downloaded from another section of the USPTO website.<sup>58</sup> The downloaded data included bibliographic information for all issued patents from 1998 to 2008. Since the downloaded data was in compressed XML (and other) formats, custom software was developed by the author to extract the pertinent bibliographic information from the downloaded compressed files. The extracted information was then used to calculate the various statistics that are presented in the next section.<sup>59</sup>

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<sup>56</sup> This option allows the search of issued U.S. patents based on multiple criteria such as an inventor’s name, inventor’s residence, the title of the patent and others. For example, a search based on an inventor’s name produces a listing of all patents issued to that person. See USPTO, Patent Full-text and Full-Page Image Database, *supra* note 51.

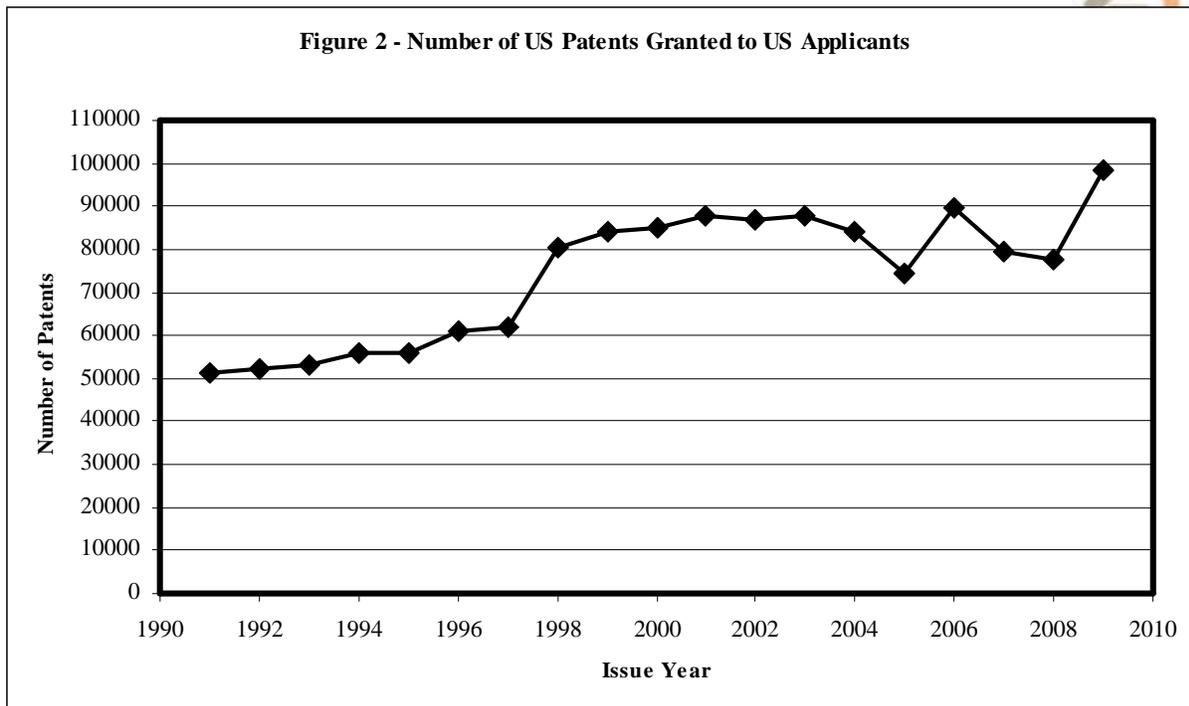
<sup>57</sup> While it may be difficult to make such an assessment based on a given first or last name, it is often easy to recognize the origins of a full name. For example, a search based on the name “Reza” resulted in a number of patents issued to both “Ahmadreza Rofougaran,” which is certainly an Iranian name, and “Reza-ur Rahman Khan,” which is quite unlikely to be an Iranian name.

<sup>58</sup> USPTO, Patent Grant Bibliographic Data, <https://eipweb.uspto.gov/SOMS/start.swe?SWECmd=Start&SWEHo=eipweb.uspto.gov> (last visited March 4, 2010).

<sup>59</sup> The above-produced list of patent numbers with at least one Iranian-American inventor corresponds to patents issued from 1976 to 2010. However, the availability of free-of-charge bibliographic data at the USPTO limits some of the analysis that is presented in this paper to patents issued from 1998 to 2008.

## B – Results

Before examining the statistics related to Iranian-American inventors, it is instructive to examine the numbers and trends associated with patents issued to all U.S. residents during the past decade.<sup>60</sup> Figure 2 illustrates the number of U.S. utility patents issued to inventors with U.S. residences between 1998 and 2009.<sup>61</sup> As evident from Figure 2, the number of patents granted to U.S. Applicants has remained relatively flat since 1998, with a recent spike in 2009.



### B-1 - Number of Patents

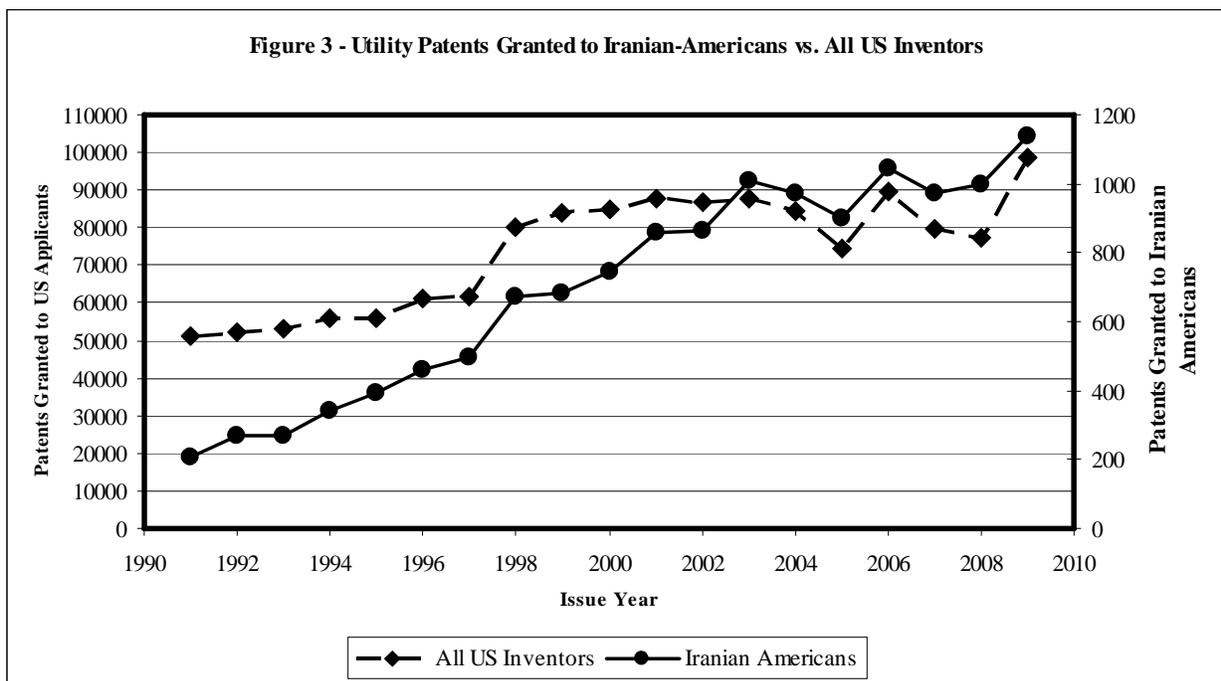
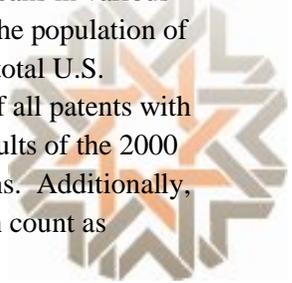
Figure 3 illustrates the number of U.S. patents issued to Iranian-American inventors (solid line) that is superimposed on top of the plot that was illustrated in Figure 2 (dashed line). The numbers on the right-hand side of the plot are associated with issued patents with Iranian-American inventors, while the numbers on the left-hand side represent the total number of patents issued to U.S. residents. The plots in Figure 3 reveal an upward trend in the number of patents issued to Iranian-Americans when compared to the general U.S. population.

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<sup>60</sup> The types of patents that are primarily granted by the USPTO are: utility, design and plant patents. For the purposes of this paper, only utility patents, which constitute the majority of all issued patents, were considered.

<sup>61</sup> USPTO, Patents By Country, State, and Year - Utility Patents, [http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst\\_utl.htm](http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_utl.htm) (last visited May 23, 2010).

This trend is better illustrated in Figure 4, which shows the percentage of patents of U.S. origin that were granted to Iranian-American inventors. According to Figure 4, from 1991 to 2008, this percentage has tripled, which is likely indicative of a larger participation and influence of Iranian-Americans in various areas of U.S. science and technology. As noted earlier, based on the 2000 U.S. Census, the population of Iranian-Americans was estimated to be about 300,000, representing a little over 0.1% of total U.S. population.<sup>62</sup> Figure 4 demonstrates that the same population has obtained roughly 1% of all patents with U.S. origin. This disproportionate grant of U.S. patents partially confirms the overall results of the 2000 Census that indicated higher than average education levels achieved by Iranian-Americans. Additionally, this disparity may be attributed to an underestimation of the Iranian-American population count as established by the 2000 Census data.



<sup>62</sup> See Hakimzadeh & Dixon, *supra* note 2.

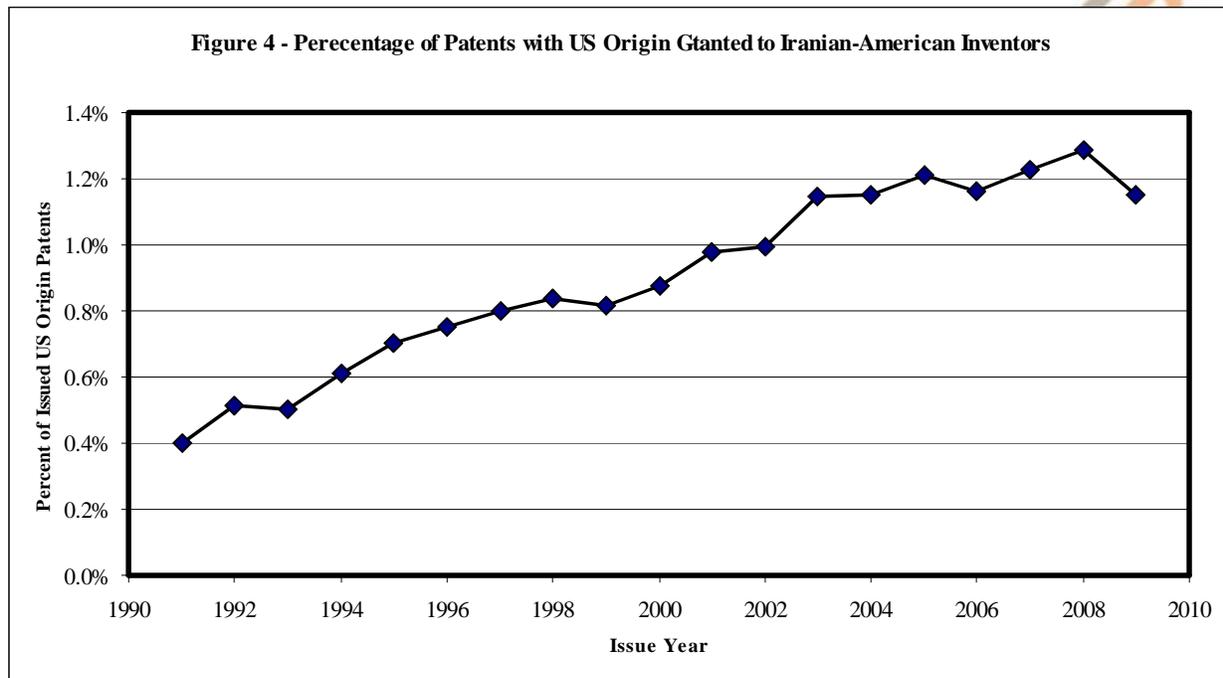


Table 1 is a listing of a few Iranian-American individuals with an impressive number of issued patents. These names were discovered by manually analyzing some of the search results, and through inquiries made to various colleagues. Therefore, it is entirely possible that the author may have failed to discover the names of other equally accomplished individuals.

**Table 1- Top Iranian-American Patent Holders**

<i>Name</i>	<i>Number of Issued Patents (1976-2009)</i>
Frankie Fariborz Roohparvar	342
Hossein Eslambolchi	180
Arya Reza Behzad	95
Nima Mokhlesi	90
Ahamdreza Rofougaran	80

An interesting note about Table 1 is that all listed individuals are male. The top Iranian-American female patent holder during the same period was Dr. Manijeh Razeghi, with 40 patents. Gender of the patent holders is further analyzed in the next section.



## B-2 - Gender and Geographic Distribution

The statistics related to gender and geographical distribution of the Iranian-American inventors are presented in Figures 5 and 6. These figures are based on bibliographic data for patents issued from 1998 to 2008.

Figure 5 shows that only 7% of Iranian-American inventors are female. Such a gap between the male and female numbers can be explained by several factors. The 2000 U.S. Census data indicates that a higher proportion of Iranian-American males hold advanced degrees.<sup>63</sup> In addition, males outnumber females by 55% to 45%.<sup>64</sup> Therefore, a certain amount of gender disparity in the number of patent holders is to be expected. Furthermore, the final list of Iranian names assembled in this study included 120 male first names but only 88 female first names. As described earlier, the original list of names was carefully pared down to remove non-Persian first names. This elimination process may have disproportionately affected the list of female names.<sup>65</sup> Additionally, the methodology used in this paper would not discover Iranian-American female inventors with non-Persian first names and non-Iranian last names.<sup>66</sup>

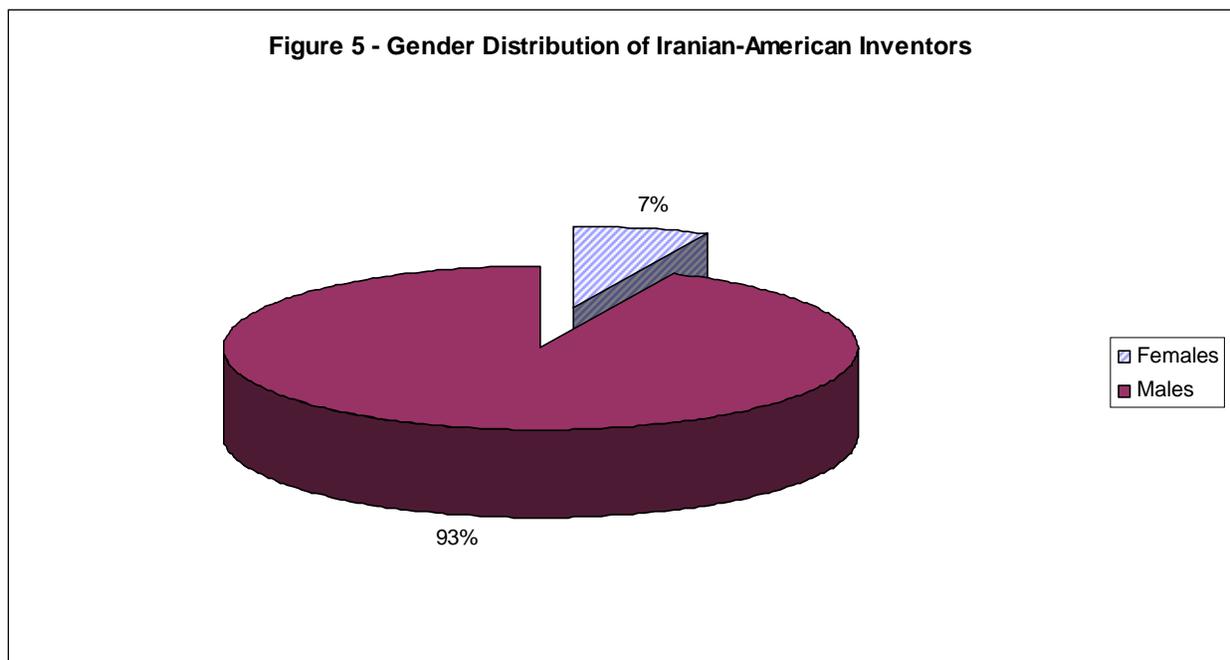


Figure 6 illustrates the geographical distribution of Iranian-American inventors. Close to 50% of all Iranian-American inventors live in California. This percentage is considerably higher than the national numbers that indicate 20% of all U.S. inventors are from California.<sup>67</sup> However, these result should

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<sup>63</sup> Mostashari & Khodamhosseini, *supra* note 2.

<sup>64</sup> *Id.*

<sup>65</sup> Searches that were conducted based on last names, however, have likely captured a few of the eliminated first names.

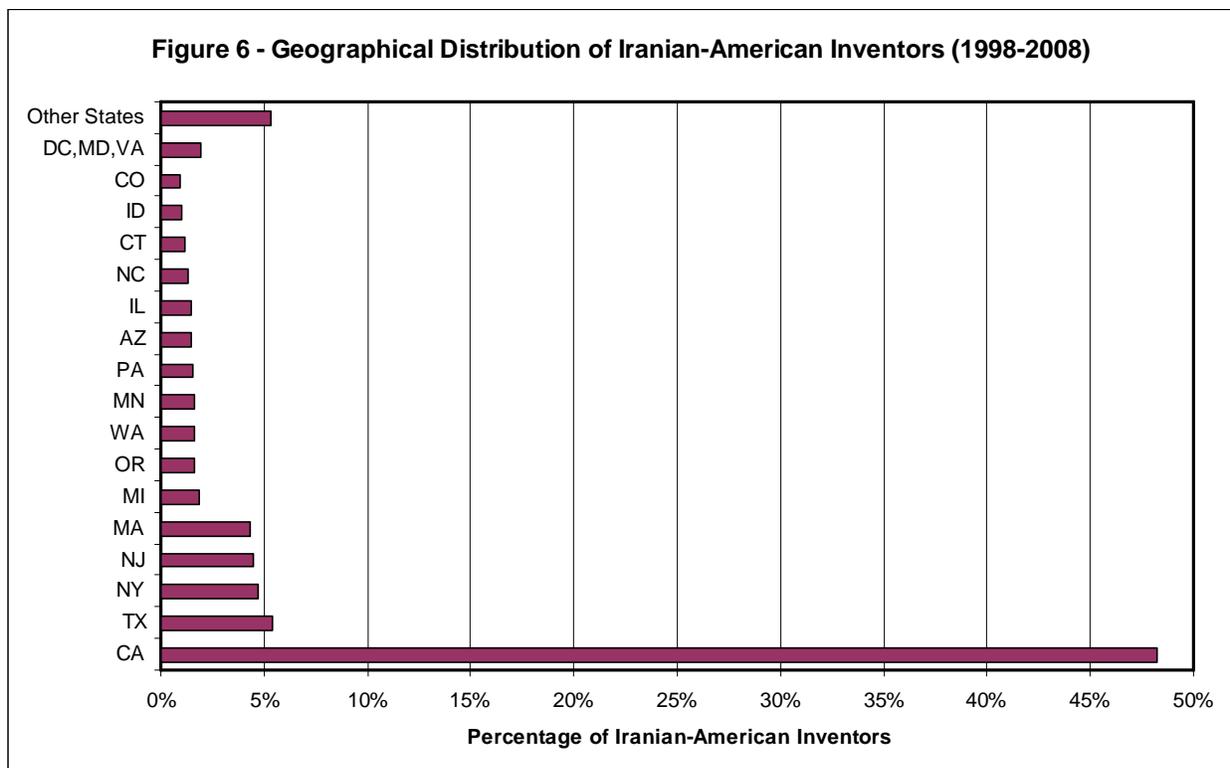
<sup>66</sup> For example, the present methodology would not discover “Zahra Johnson,” who may very well be a female Iranian inventor.

<sup>67</sup> See USPTO, Patents By Country, State, and Year, *supra* note 61.



come as no surprise since California is believed to be home to a large number of Iranian-Americans.<sup>68</sup> Figure 6 further shows Texas, New York, New Jersey and Massachusetts round up the top five states, each being home to about 5% of Iranian-American inventors.

Perhaps a more interesting result is associated with the states of Maryland, Virginia and the District of Columbia, which are also believed be home to a high concentration of Iranian-Americans.<sup>69</sup> The data presented in Figure 6 indicates that these states, when combined together, produce less than 2% of Iranian-American inventors. This percentage is lower than the national numbers that indicate 3.3% of all patents with U.S. origin were issued to residents of Maryland, Virginia and Washington DC in the period 1998-2008.<sup>70</sup> The lower patent activity of Iranian-Americans in the DC-Maryland-Virginia area may indicate that this segment of the Iranian-American community is less involved in science and technology.



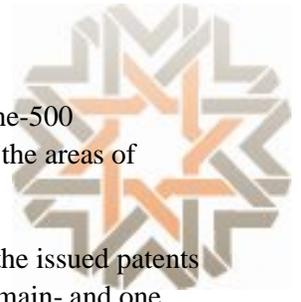
### *B-3 - Patent Assignees and Areas of Innovation*

Obtaining a U.S. patent is an expensive and time-consuming endeavor. Therefore, most patents are filed and maintained by corporations as part of their research and development activities. The results of the present study revealed 721 different patent owners (i.e., assignees) for patents issued to Iranian-American inventors during the period 1998-2008. Figure 7 illustrates the top five assignees of the patents issued to

<sup>68</sup> Hakimzadeh & Dixon, *supra* note 2.

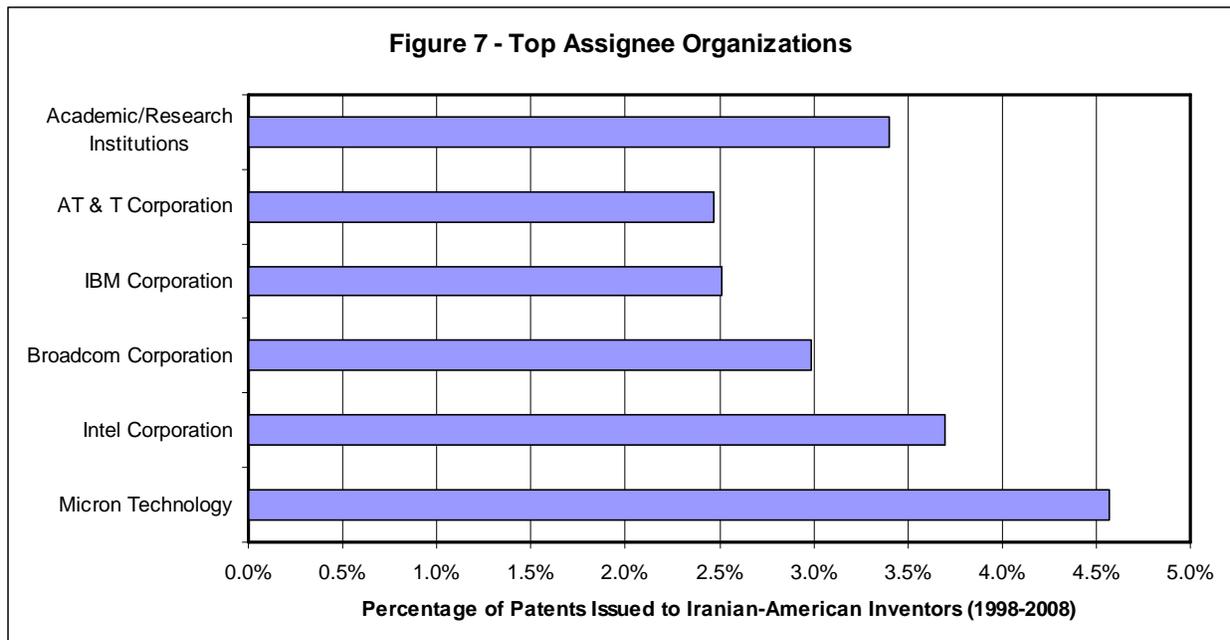
<sup>69</sup> *Id.*

<sup>70</sup> USPTO, Patents By Country, State, and Year, *supra* note 61.



Iranian-American inventors. The complete list of assignees, which includes many Fortune-500 companies and top-tier universities, provides a snapshot of the inventors' employers and the areas of research activity.

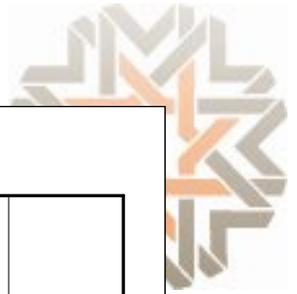
A better assessment of the type of inventive activity can be made from the front page of the issued patents themselves. The U.S. Patent Office categorizes each invention according to at least one main- and one sub-classification that appear on the face of an issued patent.<sup>71</sup> Figure 8 shows the top 10 classifications associated with patents issued to Iranian-American inventors during 1998-2008. Based on these classifications, most of the inventive activity associated with Iranian-American inventors has taken place in the fields of semi-conductor, communications and bio-technology.



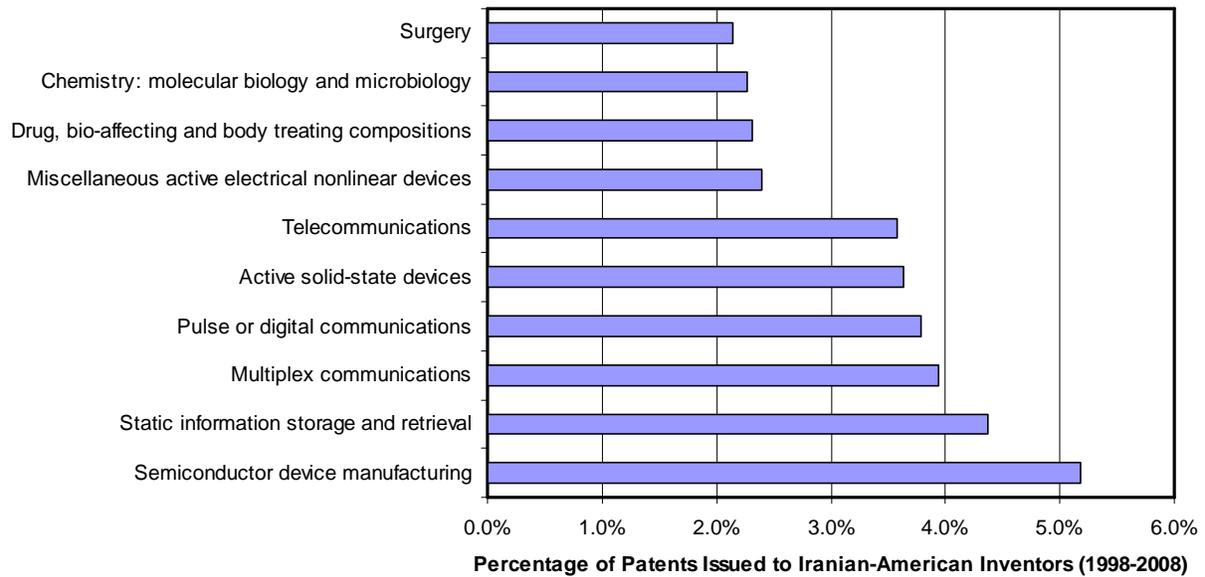
Since there are close to 1,000 different USPTO patent classifications, a better overall assessment of the different areas of inventive activity can be made by combining the results associated with closely related USPTO classifications. Figure 9 is produced by combining some of the closely related classifications to arrive at a breakdown of issued patents based on the subject matter of the inventions. These results indicate that more than 55% of the patents issued to Iranian-American inventors were related to computers, electronics, telecommunications and related fields. Chemistry, pharmaceutical and medical instrumentations made up a combined 20% of the patent activity, while the remaining activities occurred in optics and “other” fields. The “other” category includes areas such as mechanical devices, textiles, vehicles, printing and the like.

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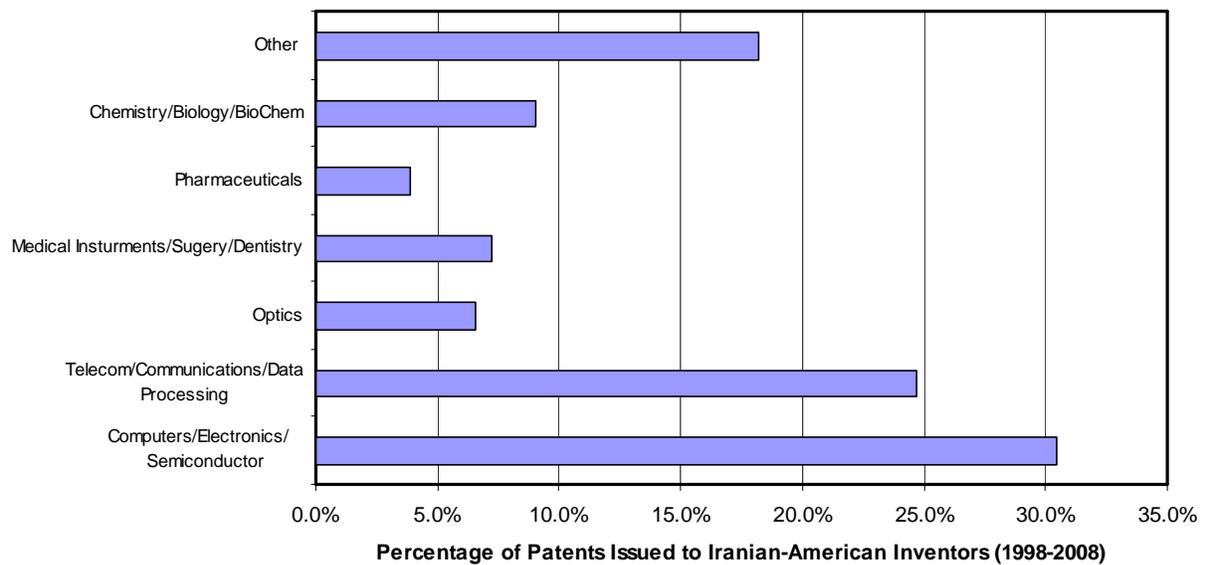
<sup>71</sup> USPTO, Classification Main Menu, <http://www.uspto.gov/web/patents/classification/> (last visited May 23, 2010).

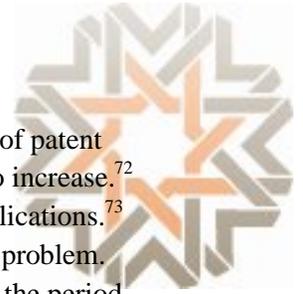


**Figure 8 - Top 10 Categories According to USPTO Classification**



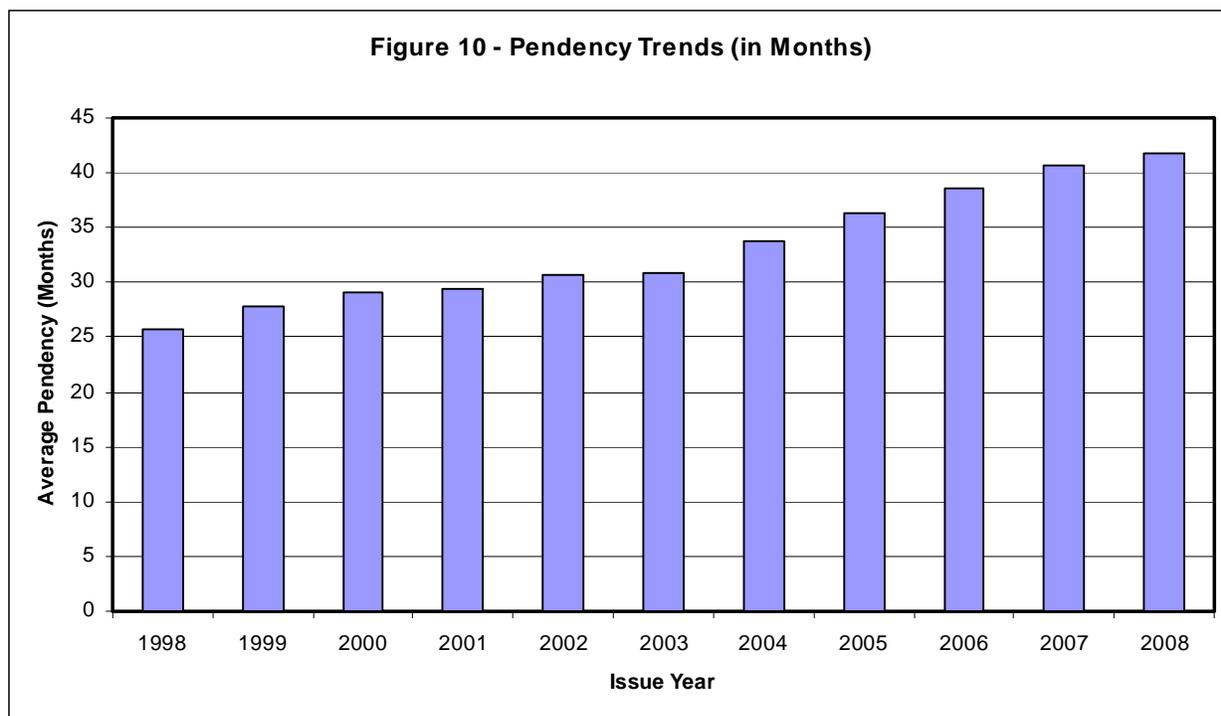
**Figure 9 - Subject Matter of Granted Patents**





One of the complaints associated with the current U.S. patent system is the long pendency of patent applications and the fact that each year the backlog of pending patent applications seems to increase.<sup>72</sup> This has led to several proposals for legislation that shorten the pendency of the patent applications.<sup>73</sup> The data collected for the present study provides an opportunity to illustrate this pendency problem. Figure 10 shows the average pendency for patents with Iranian-American inventors during the period 1998-2008. The pendency is calculated as the number of months from the time of filing the patent application to the time when the patent is issued. While the pendency data illustrated in Figure 10 includes delays attributed to both the U.S. Patent Office and the patent applicants, the observed trends are consistent with similar results reported by the USPTO.<sup>74</sup> As Figure 10 illustrates, the pendency has increased from about 25 months in 1998 to over 40 months in 2008. As a result, a patent with an issue date in 2008 is likely to have been filed sometime in 2005.

The long delays that are presented in Figure 10 also introduce a “time-shift” in some of the results discussed in this paper. For example, residency information of the inventors is typically submitted to the USPTO at the time of filing the patent application. Therefore, the statistics related to geographical distribution of the inventors during 1998-2008, in reality, correspond to their geographical distribution during the period 1996-2006.



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<sup>72</sup> See Patrick A. Doody, *How To Eliminate The Backlog At The Patent Office*, 37 (no. 4), *AIPLA Q.J.*, 395 (2009).

<sup>73</sup> *Id.*

<sup>74</sup> See USPTO, Table 4: Patent Pendency Statistics [http://www.uspto.gov/web/offices/com/annual/2007/50304\\_table4.html](http://www.uspto.gov/web/offices/com/annual/2007/50304_table4.html) (last visited May 23, 2010).



## VI. CONCLUDING REMARKS AND FUTURE CONSIDERATIONS

The author believes that the assembled list of Iranian-American names is by no means a comprehensive list of all Iranian-American inventors. In fact, a significant number of Iranian-American inventors are likely to have been overlooked since a large number of non-Persian first and last names were removed from consideration. However, the object of this study was to provide a conservative estimate of Iranian-American innovators and their contributions to U.S. science and technology. Consistent with this objective, the results indicate that the number of Iranian-American patent holders has been steadily increasing in the last decade. Over the five-year span from 2005 to 2009, for example, about 1.2% of all patents issued to US applicants were granted to Iranian-American inventors. This percentage, which is based on the conservative approach of this paper, still represents a significant number of all U.S. patents that have been granted to members of the relatively small Iranian-American community.

While it is true that not all innovative activities can be measured by the number of issued patents, this metric provides an objective criteria that can be accurately measured from the data readily available at the USPTO website. In addition, although it is difficult to determine the exact value of a patent, there is little doubt that patents play an important role in protecting the intellectual property of many companies, fostering innovations, fending off lawsuits and increasing the valuation of companies. These contentions are supported by the ever increasing number of patent applications that are being filed with the U.S. and other patent offices around the world despite the expense and time that is involved in filing and prosecuting these patents. The data that was obtained in this study indicates that the Iranian-American community has been an active participant in the discovery and development of innovative products and processes that have resulted in patents. These innovative activities in the past decade have been concentrated in the areas of computers, communications and electronics, in addition to pharmaceuticals and biotechnology.

The present study also illuminates certain geographical and gender characteristics of Iranian-American inventors. These results, not very surprisingly, point to California as the home state of close to half of Iranian-American inventors. The more surprising result relates to the proportion of female inventors, which only make up about 7% of all Iranian-American inventors. Some of this disparity may be due to the omission of too many non-Persian female first names from the search criteria.

To further improve the results of this study, the author appreciates receiving full names of Iranian-American inventors from the readers of this article. The author anticipates augmenting the present results by additional patents that are discovered when new names are added to the current list of Iranian-American inventors. In addition, the author envisions extending the methodology used in this paper to similarly analyze U.S. patent applications that are currently pending at the USPTO.