In the recent years, the business environments in Korea, as in most other industrialized countries, have been going under revolutionary changes by adopting artificial intelligence (AI) technology. Since the technology gets popular widely in a short period, there are surging demands of AI manpower not only in the experienced level but also in the entry level. Specifically, we observed by analysing software (SW) job announcements that in about half the cases they require more than 4-year education in college for their new employees without previous job experiences in big data/AI job positions. With the increasing industrial demands in the new technology, there are ongoing efforts in higher educational institutes to provide qualified graduates in the AI fields. We surveyed what skills are required in which application fields.

Keywords: Higher Education, Artificial Intelligence

I. INTRODUCTION

Recently the demand for manpower in the entire SW industry has been steadily increasing in Korea. Among the sub-classifications of the SW industry, SW development and supply, computer programming, and system integration and management have the highest demand for manpower and are expected to continue increasing in the future [1]. In particular, the demand for manpower for SW development has played a leading role. Among the SW industry manpower, the proportion of employment according to job types is the highest in application SW developers, system SW developers, and information system operators, in the descending order. The employment share of application software developers is expected to increase in the future along with computer security experts.

The demand for applied SW manpower is highly dependent on the growth of the industries and their requirements on specific technologies. Major industries that are expected to accelerate the increase in the number of employments include information and communications broadcasting, specialized science, health society, and electrical and electronic equipment industries. Those increment are mostly due to the increase in demand for technical manpower resulted from the emergence of new innovative technologies. In addition, other industries, that are expected to decrease the total number of employments due to the revitalization of internet commerce and the emergence of innovative technologies and unmanned services, are wholesale and retail, food and lodging, public administration, and construction industries.

In this paper, we studied the impact of the recent development in AI technologies on the SW industry job markets. Due to the relative complexity of its theoretical backgrounds, AI field needs qualifications different from traditional SW jobs.

By analysing the job announcements, we identified the requirements on education level and technical skills, specially for new college graduates who pursue their career in the AI-related SW industry. We discussed how these changes caused by AI developments can work as the opportunities for higher education institutes in Korea.

II. SW JOB DEMANDS

We analysed the number of SW job postings in the information technology industries registered in a representative job portal in Korea, to understand the recent demand for SW manpower in Korea. The number of recruitment announcements is the most for application programmers, web programmers, network/server/security programmers, system programmers, in the order descending order. The survey shows the overall demand for application SW jobs is high.

The portal classifies job postings in the big data/AI field into a separate group. Recruitment announcements for the big data/AI group are the fewest among the SW-related job groups as of the survey. The proportion of big data/AI job postings for employees with no career was 33.3%, which is higher than 25.5%, the average for all job groups. It was significantly higher than 24.1% for application programmer group and 21.7% for web programmer group. With the recent expansion of the application of big data/AI technology and the need for it, it is recognized that it is relatively not easy to hire employees with careers. This can be a relatively beneficial effect for job seekers for the first time in their job career, such as those who have just completed their higher education.

The most level of education required for new recruits was a two- or three-year college graduation (including non-academic background and high school graduation). Figure 1 shows that the proportion was 78.5%. In most job groups, the proportion of recruitments requiring a 4-year university graduation or higher is around 19–26%. However, in the big data/AI job group, 48.7% of the recruitments of employees with no career

![Fig. 1. SW Job Announcement Analysis by Sectors](image-url)
required an education level of at least four-year university graduation. It is judged that there are many needs for university graduates in big data/AI jobs. If a higher education institute considers opening a new course in big data/AI, they can meet the industrial needs.

When the companies that want to hire new SW manpower are classified by industry sectors, as expected, IT/information and communication companies accounted for the majority. Other than IT/information communication sector, there were many new recruits of SW manpower in manufacturing production/chemical sector, and not many in other industry sectors such as service, medical/pharmaceutical, and finance/banking. Recruitment announcements for new SW personnel in department stores/distribution/wholesale/retail and logistics/transport/delivery sectors were at the lowest level (Figure 2). Even though IT/information and communication sector hired the most of the new SW employees, only 18.8% hired new employees with a four-year college degree or higher, which was less than half compared to those employed in other sectors excluding service sector. In comparison, 46.3% of medical/pharmaceutical companies and 37.7% of manufacturing/production/chemical companies employed new positions with highly educated SW personnel. In the case of logistics/transportation/delivery and department stores/distribution/wholesale/retail companies, the ratio of hiring high-educated new recruits was 40.0% and 33.3%, respectively, but the number of employments in those two sectors were relatively small. In terms of the demand of high-tech graduates, there is an advantage of educating SW manpower specialized in the medical/pharmaceutical and manufacturing/production/chemical industry sectors. They have a large number of new recruits for SW manpower and a high rate of recruiting new employees with college graduates or higher.

III. TECHNOLOGY SKILL DEMANDS

Most of the existing AI education programs focus on teaching the AI frameworks widely used in the industry to develop new services with basic knowledge of deep learning technology. When a higher education institute educates their students in the AI field, it should take into account the curriculum period and the diversity of trainee’s major in the previous institute, if any, they enrolled. Of course, the education course also needs to consider the knowledge level and scopes expected by the potential employers. In consideration of the work capabilities of new college graduates required by companies, the basic skills of not only AI technology but also general-purpose programming and data analysis skills in the IT field should be prepared. In order to find out the abilities that AI related companies require from their new employees, we analysed the hiring announcements for AI SW fields (Table 1). Tensorflow is the most demanded for the ability to use AI platform. Others include Keras, Caffe, PyTorch, etc. As for programming languages, Python is the most in demand. But C/C++ is also highly required in the application SW development jobs. In addition, through interviews with experts in the AI industry, we confirmed the importance of programming and collaboration skills, which are basic practical skills as a SW developer.

IV. AI-RELATED JOBS AND PREFERRED SKILLS

According to the statistics from the Venture Business Association, more than half of the 15,782 venture companies are located in metropolitan areas such as Gyeonggi (28.7%) and Seoul (28.0%) [5]. According to the Artificial Intelligence Industry Association, which is a group of representative AI companies, AI technology-based SW development and solution companies are also concentrated near Teheran-ro in Gangnam/Seocho-gu, Seoul and Seongnam, Gyeonggi, where Pankyo Techno Valley is located [6]. It is judged that it will be advantageous to provide AI-related education courses on campuses close to the areas where these companies are concentrated in terms of the connection to the industrial demands.

According to the employment portal Job Korea 2016 survey [7], the wage level of new employees varies greatly depending on the size of the company (the initial wage for companies with less than 50 employees is 23.97 million won, which is 66% of
the 36.5 million won for companies with 1,000 or more. However, as the position level gets higher, the wage difference by company sizes gets smaller significantly. In the SW industry, companies prefer employees with longer careers. They have a well-established compensation system according to work experiences. Considering these characteristics of job market in the SW industry, the fresh graduates from AI education institutes in Korea which plan to competitive education to their students.

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