

An Empirical Analysis of Coffee Franchise Location Strategies: Evidence from Gyeonggi Province

Youngtae Youn¹, Dongyoup Lee^{2*}

¹Department of Computer Science, Pennsylvania State University

²College of Business Administration, Kookmin University

경기도 커피 전문점의 입점 전략에 대한 실증 연구

윤영태¹, 이동엽^{2*}

¹펜실베이니아 주립대학교 컴퓨터공학과, ²국민대학교 경영대학

Abstract This article examines the location strategies of coffee franchises in Gyeonggi province. Due to its large population, broad area, and diverse industrial structure, Gyeonggi province is an ideal dataset for empirical testing of the location strategies. We collect the addresses of five major coffee franchises stores, convert them into geographic coordinates using Google Maps Geocoding API, and compute Haversine distances both between stores of the same franchise and between stores of different franchises. This novel approach leads to three discoveries. First, coffee-consuming age population is positively related to the number of stores and more strongly for commercial areas with a large floating population. Second, one third of Starbucks stores have another Starbucks store within a radius of 300m, which empirically confirms the 'Focused Destroy Strategy' of Starbucks that has multiple stores in central business districts. Third, for 80% of Starbucks stores, we can find Ediya stores within 500m, which supports Ediya's 'Next-to-Starbucks Strategy'. Our research methods can be efficiently applied to the analyses of other retail businesses such as convenience stores, fast food restaurants, and mobile phone shops.

요 약 본 논문은 경기도의 5대 커피 프랜차이즈의 매장 위치 정보를 분석하여 각 브랜드의 커피 전문점의 입점 전략을 실증적으로 고찰한다. 경기도는 대도시와 비교해 상대적으로 넓은 면적, 많은 인구수, 다양한 산업구조를 지니고 있어 프랜차이즈의 경영 전략에 대한 연구를 수행하기 적합한 지역이라 할 수 있다. 이에 5대 커피 프랜차이즈의 경기도 내 모든 매장의 주소 정보를 수집하고, Google Maps Geocoding API를 통해 위도와 경도에 기반한 정확한 위치 정보로 변환한 다음, 이를 Haversine 공식에 대입하여 매장들 간의 거리를 미터 단위로 측정한다. 지금까지 계량적으로 입증하기 쉽지 않았던 비즈니스 주체들의 입점 전략을 매장사이의 실제 거리를 이용하여 실증적으로 조사하는 것은 새로운 시도이며, 이를 통해 다음의 세 가지 사항을 발견할 수 있다. 첫째, 자치구내 매장의 수와 커피 소비 연령 인구는 양의 관계를 가지며, 특히 유동인구가 많고 상권이 발달한 지역에서는 더 많은 매장을 찾을 수 있다. 둘째, 33%의 스타벅스 매장으로 부터 반경 300m 이내의 지역에서 다른 스타벅스의 매장을 발견할 수 있으며, 이는 중심 상권에 다수의 매장을 배치하는 스타벅스의 집중적 초도화 전략을 잘 반영한다. 셋째, 80%의 스타벅스 매장으로 부터 500m 이내에 이디야 커피의 매장이 자리하고 있으며, 이는 스타벅스의 옆자리에 입점하려는 이디야 커피의 전략을 구체적으로 설명한다. 본 연구의 분석 방법은 편의점, 패스트 푸드점, 휴대폰 판매점과 같은 여러 체인 소매업종 입점 전략 분석에도 유용하게 적용될 수 있다.

Keywords : Business Strategy, Coffee Store, Geostatistics, Gyeonggi Province, Location, Retail Franchise

*Corresponding Author : Dongyoup Lee (Kookmin University)

Tel: +82-2-910-5657 email: dlee@kookmin.ac.kr

Received July 26, 2016

Revised (1st August 8, 2016, 2nd August 9, 2016)

Accepted August 11, 2016

Published August 31, 2016

1. Introduction

Korea's coffee market has risen sharply over the past decade. Korea's coffee consumption per capita has roughly doubled since 1990 and the number of coffee shops nearly quadrupled since 2011 [1]. Koreans are now amongst the top global consumers of coffee. They drink coffee 12.2 times per week while they eat kimchi 11.9 times and white rice 6.9 times [2], and the country becomes home to about 50,000 chain and stand-alone coffee shops. As high-quality coffees brewed by professionally trained baristas has been very popular, coffee chain industry has experienced the explosive growth as well. When coffee franchises have expanded business to access to a fresh market, they have to consider geographic strategy to have a competitive advantage and to add value to their current business. By selecting better sites than its competitors, a franchise is able to obtain a greater share of potential customers. Therefore core business strategies of the firms are reflected in how they choose the locations of shops [3]. Motivated by these backgrounds, we take a close look at the store location distribution of major coffee franchises in Gyeonggi province.

Gyeonggi province is an ideal dataset for coffee franchise analysis due to the sheer number of its

inhabitants and coffee stores. The population in Gyeonggi province has been over 12 millions in 2010s. As shown in Table 1, the province has 911 retail stores of five major franchises coffee shops such as Starbucks, Ediya, Caffe Bene, Hollys Coffee, and Tom N Toms. Although these five franchises are operating 4320 coffee shops nationwide, Seoul and Gyeonggi province collectively cover more than half of the entire coffee shops.

For comparative analysis of coffee retail store's location strategies in Seoul, Gyeonggi province is also a quintessential place due to the two distinguishing characteristics. First, the residence pattern in Gyeonggi differs from that in Seoul. The population density of Gyeonggi is 1,218 per km², which is much smaller than that of Seoul, 16,219 per km², although Gyeonggi is about 17 times larger than Seoul. Second, the economic structure of Gyeonggi differs from that of Seoul. The province contains a significant amount of rural areas despite the rapid growth and urbanization of Korea. Compared to Seoul, Gyeonggi province spans business across diverse fields including heavy, light and agricultural industries. Therefore we investigate whether coffee franchises are making use of same strategies in Gyeonggi which has quite different characteristics from Seoul and expect that this research

Table 1. Number of Coffee Stores by Province in 2016

Province	Ediya	Starbucks	Caffe Bene	Hollys	Tom N Toms	Total
Seoul	563	370	175	154	161	1,423
Gyeonggi	412	168	151	94	86	911
Busan	173	81	43	22	41	360
Incheon	126	38	47	15	13	239
Gyeongsang South	89	35	32	20	17	193
Jeolla North	82	13	14	20	26	155
Daegu	34	48	40	18	10	150
Gyeongsang North	49	33	26	18	15	141
Chungcheong South	36	11	34	16	24	121
Daejeon	20	35	29	13	11	108
Gangwon	38	15	35	9	9	106
Gwangju	15	33	26	19	7	100
Ulsan	38	17	22	8	5	90
Chungcheong North	24	12	23	22	7	88
Jeolla South	19	8	16	12	12	67
Jeju	10	11	18	2	8	49
Sejong	5	5	4	4	1	19
Total	1,733	933	735	466	453	4,320

extend our understanding over fundamental management policies of retail businesses.

Since Stevens [4] proposed a method on how to apply game theory to the problem of location strategy in a simple setting, the strategies of making decisions on locations of retail stores have been examined by academics. Ghosh and Craig [5] presented a model for evaluating sites in a dynamic environment and Joo [6] found that local demand and competition influence the entry decision of chain restaurants. There are also papers studying on Korean coffee market. Kim [7] demonstrated the location strategies of Starbucks in Korean market, but it did not investigate with geographic data. Our research empirically tests the strategies by analyzing distances between stores. Shin and Moon [8] explored the effects of location characteristics on the sales of coffee stores and Sin and Choi [9] analyzed the factors determining the locations of coffee shops. However none of previous studies explain the location strategies of retail shops using exact spots such as addresses. Recently, the authors empirically confirm the location strategy of coffee franchise in a megacity, Seoul, based on geostatistical analysis [10]. We apply the research method to Gyeonggi province to discover whether the similar strategies are employed.

We analyze the distributions by measuring and comparing the distances between any pair of stores. Due to the sheer number of more than 900 coffee stores, the pairwise distance computation becomes feasible only through a computer-based analysis. Unlike counting stores by district as done in most of previous research, our approach clearly delivers ideas of location strategies by providing how closely the stores of the same brands are concentrated and how far the stores of different brands are distributed. For pairwise distance computation, we collect the addresses of major coffee franchises and convert them into geographic coordinates of latitude and longitude using Google geocoding API. Then we apply the formula of Haversine to calculate the great circle distance which is

the shortest distance between two points on the surface of a sphere.

Our main empirical result directly illustrates the location strategies of coffee franchises. We find a positive relationship between coffee-consuming age population and the number of coffee stores. This implies that firms open more stores where potential customers are highly expected. The fact that number of stores are especially high for central business districts such as Bundang shows that floating population plays an important role in decision making process for geographic strategy. Using distance analyses we also find evidences supporting the core business strategies of the franchises. For Starbucks, lots of stores are concentrated in large commercial areas and distances between any pair of them are relatively shorter. This certainly documents ‘Prime Location Strategy’ and ‘Focused Destroy Strategy’ of Starbucks. Ediya has comparably more stores in suburban areas and its shops in central areas have tendency to be located close to Starbucks store. These findings justify Ediya’s ‘Subprime Location Strategy’ and ‘Next-to-Starbucks Strategy’.

The rest of the article is organized as follows. Section 2 describes and compares the location strategies of Starbucks and Ediya. Section 3 summarizes data and methodology of estimating distances between any pair of stores. Section 4 presents results of geostatistical analyses, and Section 5 concludes.

2. Strategies of Coffee Franchises

Since its arrival, Starbucks has been using ‘Prime Location Strategy’ and ‘Focused Destroy Strategy’. Starbucks has been the leading company in the coffee franchise industry and already takes the best location in most of the business districts. It makes use of ‘Prime Location Strategy’ to have stores in some of the most prime location which has high-traffic and

high-visibility such as downtown retail centers. It operates large-scale stores to appeal visually and to provide an environment of community meeting spot because Starbucks aims to make its stores a ‘third place’ besides home and work. Starbucks, unlike other franchises, directly manages all stores which enables it to make use of ‘Focused Destroy Strategy’ [7]. It opens multiple stores at main streets, crossways, and stations in commercial areas and central business districts where the huge amount of floating population is. This strategy might lower profitability per store but raise total profit for Starbucks from doing business at the location. Furthermore, multiple stores in one area can also enhance the marketing promotion and some management systems including training programs. This helps Starbucks keep a strong market position and a powerful brand image.

As opposed to Starbucks, Ediya has been using ‘Subprime Location Strategy’ and ‘Next-to-Starbucks Strategy’. It is operating mostly small shops in subprime locations in order not to directly compete with the coffee giant [11]. Rather than running large-scale stores on main street, Ediya runs small size shops off main street and encourage take-out [12]. This differentiated strategy has allowed it to offer premium coffee at lower prices, appealing to customers on a tighter budget [13]. This also attracted a large number of interested franchisees seeking to run a coffee shop at lower costs which leads Ediya to have the largest number of shops in Korea. Interestingly, though Ediya stores are off main street, they are known to be near from Starbucks stores. If there is a Starbucks store, Ediya believes that it is highly likely that there are many potential customers for coffee and selecting the location near Starbucks can save the costs for conducting market research and advertisement.

3. Data and Methodology

The main datasets of locations are obtained and processed as follows.

(1) Every coffee franchise provides the detailed information on its retail stores at homepage. Through ‘Find a Store’ menu at the homepage we refine a search query, and this functionality may be narrowed into a specific area. We develop a Python script for each franchise that automatically extracts the store addresses in Gyeonggi Province. Other than basic Python library, BeautifulSoup package plays a crucial role in parsing the HTML document returned by the ‘Find a Store’ menu. Sometimes, this script does not work as expected because the website may contain malformed HTML scripts. The address information was double-checked by hand to ensure whether the Python script properly handles these irregularities.

(2) The main goal of this research is to compute the distance between any pair of coffee retail stores. This distance must be measured as the crow flies. But typical web mapping services such as Google Maps provides driving or walking distances only. One possible solution to get around this problem is to compute the great-circle distance between two stores based on their geographic coordinates of latitudes and longitudes. The great-circle distance is the shortest distance between two points on the surface of a sphere, measured along the surface of the sphere as opposed to a straight line through the sphere's interior. To get the distances, we convert the address information from (1) into geographic positions using Google Maps Geocoding API and apply the Haversine formula that relates a pair of longitudes and latitudes with the great-circle distance between them [14]. For two points on a sphere of radius r with latitudes θ_1 and θ_2 , and longitude ϕ_1 and ϕ_2 , where angles are in radians, the distance d between the two positions along a great circle of the Earth with a radius of 6,400km is obtained as follows:

$$d = 2r \arcsin \sqrt{\sin^2 \left(\frac{\theta_1 - \theta_2}{2} \right) + \cos \theta_1 \cos \theta_2 \sin^2 \left(\frac{\phi_2 - \phi_1}{2} \right)}$$

4. Empirical Results

4.1 Population and Stores

Table 2 shows the number of stores by district in Gyeonggi province for 5 coffee franchises in 2016. Ediya operates the most stores of 412, Starbucks has the second most of 168, and Tom N Toms has the least

number of stores, 86. Bundang, the largest business district in Gyeonggi, is also the most crowded district in terms of coffee franchise shops. It has 86 stores of all brands which are about 9% of all stores in Gyeonggi. Starbucks runs 31 stores in Bundang and it accounts for more than 18% of its stores in Gyeonggi while Caffè Bene has only 6 stores which is less than

Table 2. Number of Coffee Stores by District in Gyeonggi Province

Province	Ediya	Starbucks	Caffè Bene	Hollys	Tom N Toms	Total
Ansan Danwon	15	6	4	4	3	32
Ansan Sangrok	5	2	0	1	3	11
Anseong	3	1	3	0	1	8
Anyang Dongan	10	6	5	4	1	26
Anyang Manan	9	3	3	1	1	17
Bucheon Ojeong	6	0	0	0	0	6
Bucheon Sosa	9	2	2	0	0	13
Bucheon Wonmi	25	9	10	5	5	54
Dongducheon	2	2	2	1	0	7
Gapyeong	3	0	1	0	0	4
Gimpo	14	5	1	2	2	24
Goyang Deogyang	20	5	4	4	2	35
Goyang Ilsanseo	14	7	4	1	1	27
Goyong Ilsandong	13	9	5	5	1	33
Gunpo	4	3	1	1	2	11
Guri	10	2	3	1	1	17
Gwacheon	1	2	1	0	0	4
Gwangju	3	1	1	0	1	6
Gwangmyeong	8	3	3	3	4	21
Hanam	4	2	1	1	2	10
Hwaseong	12	6	8	8	4	38
Icheon	6	3	4	1	1	15
Namyangju	25	3	8	1	7	44
Osan	2	2	1	2	0	7
Paju	12	3	4	1	3	23
Pocheon	6	1	2	0	1	10
Pyeongtaek	7	5	4	3	5	24
Seongnam Bundang	28	31	6	10	11	86
Seongnam Jungwon	9	1	5	1	0	16
Seongnam Sujeong	8	1	5	2	1	17
Siheung	15	1	4	3	2	25
Suwon Gwonseon	9	2	3	2	1	17
Suwon Jangan	8	1	4	1	0	14
Suwon Paldal	9	6	5	4	2	26
Suwon Yeongtong	13	7	7	8	5	40
Uijeongbu	26	5	4	2	2	39
Uiwang	4	0	1	2	1	8
Yangju	6	1	4	3	0	14
Yangpyeong	2	0	0	0	0	2
Yeosu	1	2	2	1	1	7
Yeoncheon	1	0	1	0	0	2
Yongin Cheoin	2	1	4	1	1	9
Yongin Giheung	13	7	5	3	5	33
Yongin Suji	10	9	6	1	3	29
Total	412	168	151	94	86	911

4% of its all stores in the province. Though Ediya has almost 2.5 times more stores than Starbucks in Gyeonggi, there are more Starbucks stores than Ediya in Bundang. On the other hand, some rural districts such as Gapyeong, Yeoncheon, and Yangpyeong have less than 5 stores of all brands and no single Starbucks store. For 10 districts that have less than 10 stores of any brand, Ediya accounts for 42% but Starbucks does for only 15% of all stores, which clearly accords with the siting strategies of Starbucks and Ediya. ‘Focused Destroy Strategy’ of Starbucks results in a number of stores in Bundang and very few in rural regions while Ediya makes use of ‘Subprime Location Strategy’ to have stores all around the Gyeonggi province.

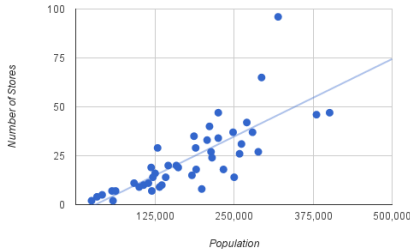


Fig. 3. Population vs. Stores for All Brands

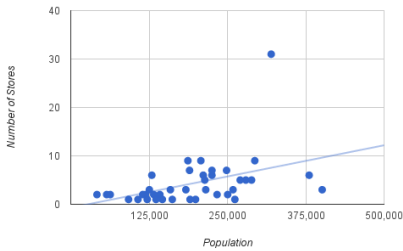


Fig. 4. Population vs. Stores for Starbucks

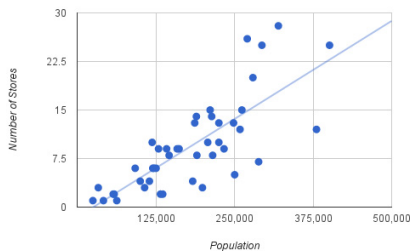


Fig. 5. Population vs. Stores for Ediya

Next, we test the relationship between the number of stores of all brands and the coffee-consuming age population. Figure 3 illustrates the scatter plot and the line of best fit. The correlation coefficient is positive, 0.77, which tells there are more stores where more potential customers are. As explained earlier, Bundang is an outlier because it is the largest business district and coffee consumption during daytime must be higher. As shown in Figure 4, the relationship is very similar for Ediya and the correlation coefficient is 0.77. But the relationship is weaker for Starbucks and the correlation coefficient from Figure 5 is 0.42. The higher coefficient for Ediya demonstrates that ‘Subprime Location Strategy’ makes it have small shops in subprime locations which leads relatively less stores in business districts and more in suburban areas. The smaller coefficient for Starbucks justifies that it opens stores in commercial districts and potential hub area.

4.2 Evidence of Starbucks’ Strategy

Table 3 reports the distributions of the distance between stores of the same franchise. The ratio of pairs of Starbucks stores located within 300m confirms its ‘Focused Destroy Strategy’. 33% of Starbucks stores have another Starbucks store within a radius of 300m while 12% of Ediya stores do. The ratios are even lower for the others. For the test with a longer distance of 500m, the ratio is still the highest for Starbucks. The ratios are 44% for Starbucks, 30% for Ediya, and less than 20% for any other. Since Starbucks directly manages all stores, there is no conflict of interest between stores unlike the other franchises. Having more stores in concentrated site might reduce profit per store but increase the total profit which enables the brand to beat the others in the fierce competition and to maintain its first place in the coffee market. Lots of stores in Bundang clearly explains this location strategy.

Table 3. Distributions of the minimum distance between stores of the same franchise

Radius	300m	500m
Starbucks	56 (33%)	74 (44%)
Ediya	49 (12%)	121 (30%)
Caffe Bene	10 (7%)	19 (13%)
Tom N Toms	4 (5%)	11 (13%)
Hollys	9 (10%)	18 (19%)

4.3 Evidence of Ediya’s Strategy

Table 4 shows the distributions of the distance between all Starbucks stores and the nearest other brand stores. By all means, Ediya stores are closest to Starbucks stores and this supports Ediya’s ‘Next-to-Starbucks Strategy’ to have its stores near Starbucks. Average distances are 317m for Ediya, 607m for Caffè Bene, 673m for Hollys, and 708m for Tom N Toms. Median distance is the smallest for Ediya as well. 26% of Ediya stores are located within 100m from any Starbucks stores and only 20% are more than 500m away from Starbucks stores. None of other brands have more than 15% of stores within 100m from Starbucks. At least 40% of other brand stores are located more than 500m away from Starbucks stores.

A comment on methodology is necessary. Whereas Ediya has more stores than Starbucks does in Gyeonggi, the others have less stores than Starbucks does. If the distance between the Starbucks store and the nearest store is more than 2km, we rule out the store in this analysis because we interpret that the brand has no intention of having a store in the region in such cases.

Table 4. Store distributions from the nearest Starbucks stores

Stat	Median	Avg	Std dev	<100m	>500m
Ediya	182m	317m	372m	26%	20%
C.Bene	320m	607m	572m	15%	41%
Tom	572m	708m	553m	8%	54%
Hollys	473m	673m	563m	11%	49%

5. Conclusion

Location selection is important for service facilities. Since it determines the business conditions such as sales potential and competition, store locations exhibit the business strategy of service firms. Using the information on retail locations, we compute the distances between the same brand stores and between the different brand stores and empirically examine the core business strategies of major coffee franchise companies in Gyeonggi province.

We find that the number of stores generally increases as the district population - the number of potential customers - does. For Ediya, the relationship is strong and this explains its ‘Subprime Location Strategy’. In contrast, Starbucks has weak relationship between the number of stores and population. It operates relatively many stores in the large business districts and few stores in suburban areas which coincides with its ‘Prime Location Strategy’.

Distance analyses provide the evidence of their business strategies in detail. Starbucks stores in commercial areas are so concentrated that they are very closely located to each other. This implies that Starbucks is pursuing ‘Focused Destroy Strategy’ to take the competitive edge over other franchises by opening multiple stores in profitable business sites.

Finally, the analysis of distances between Starbucks stores and their nearest neighbors proves that Ediya has opened stores near to Starbucks stores following its ‘Next-to-Starbucks Strategy’. Because Ediya is not directly competing with Starbucks, it opens small shops off main streets near Starbucks on main streets in business districts and have more stores in rural areas where Starbucks runs relatively few stores.

This paper also makes a contribution to knowledge about the investigative approach of geographic distributions of business entities. Unlike earlier works, we employ a novel method for exploring the distribution of retail stores by estimating the actual pairwise distances using their addresses in geographic coordinates of latitude and longitude. This can be

efficiently applied to the analyses of other retail businesses such as convenience stores, fast food restaurants, and mobile phone shops.

There is, however, still room for improvement. Our tests present the location strategies of coffee franchises at a given time and do not provide the trend. As now the market is getting more crowded and even convenience stores pose a threat by providing freshly brewed coffee at affordable prices, the core management strategies of coffee franchises will be more distinct in the future. Consequently, such strategies may be reflected in their geographic distribution both directly and indirectly by opening new stores and closing some existing stores. Therefore, geostatistical analyses using data over a certain period of time will enhance our understanding of the trend in the competition structure of coffee service industry, which would be a viable next research topic.

References

- [1] "Coffee wars: South Korea's cafe boom nears saturation point", *Reuters*, April 4, 2016, Available From: <http://www.reuters.com/article/us-southkorea-coffee-idUSKCN0X12GF>. (accessed June 4, 2016)
- [2] "Koreans consume more coffee than kimchi, rice", *The Korean Herald*, January 16, 2015, Available From: <http://www.koreaherald.com/view.php?ud=20150116000639>. (accessed June 4, 2016)
- [3] Avijit Ghosh and C. Samuel Craig, "FRANSYS: A Franchise Distribution System Location Model", *Journal of Retailing*, vol. 67 Issue 4, 1991.
- [4] Benjamin H. Stevens, "An application of game theory to a problem in location strategy", *Papers in Regional Science*, vol. 7, Issue 1, pp. 143 - 157, 1961. DOI: <http://dx.doi.org/10.1007/BF01969077>
- [5] Avijit Ghosh and C. Samuel Craig, "Formulating Retail Location Strategy in a Changing Environment", *Journal of Marketing* vol. 47, no. 3, pp. 56-68, 1983. DOI: <http://dx.doi.org/10.2307/1251197>
- [6] Haily H. Joo, "The Entry Decisions of Chain Restaurants: Evidences from the U.S. Coffee-Shop Industry", *The Korean Economic Review*, vol. 61, no. 1, pp. 31-55, 2013.
- [7] Soo-Wook Kim, "Selecting Location of Service Facilities: Siting Strategy of Starbucks in Korea", *The Journal of Small Business Innovation*, vol. 16, no. 1, pp. 61-76, 2013.
- [8] Woo Jin Shin and So Youn Moon, "A Study on the Effects of Locational Characteristics on the Sales of a Coffee Shop Franchise", *Journal of the Korea Real Estate Analysts Association*, vol. 17, no. 2, pp. 111-123, 2011.
- [9] Yu-Jin Sin and Seung-Du Choi, "Analysis of location factors in the coffee shop franchise", *Residential Environment (Journal of the Residential Environment Institute of Korea)*, vol. 12, no. 3, pp. 15-25, 2014.
- [10] Dongyoun Lee and Youngtae Youn, "A Geostatistical Analysis of Coffee Franchise Location", *Journal of Information Technology Services*, vol. 15, no. 2, pp. 203-217, 2016.
- [11] "Ediya says its coffee beans better than Starbucks", *The Korean Herald*, March 31, 2016, Available From: <http://www.koreaherald.com/view.php?ud=20160331000958>. (accessed June 4, 2016)
- [12] "Ediya goes after Asian coffee drinkers", *The Korea Times*, November 17, 2013, Available From: http://www.koreatimes.co.kr/www/news/biz/2016/06/334_146361.html. (accessed June 4, 2016)
- [13] "Ediya for Price, Starbucks for Taste", *The Korea Bizwire*, February 23, 2015, Available From: <http://koreabizwire.com/ediya-for-price-starbucks-for-taste/30615>. (accessed June 4, 2016)
- [14] Roger W. Sinnott, "Virtues of the Haversine", *Sky and Telescope*, vol. 68, no. 2, pp. 159, 1984.

Youngtae Youn

[Regular member]



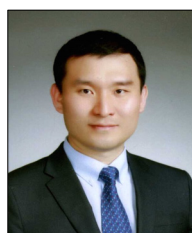
- Feb. 2003 : B.S. in Electrical Engineering, Seoul National University
- Aug. 2005 : ME. in Communication Engineering, POSTECH
- Aug. 2007 ~ current : Ph.D. Candidate in Computer Science, Pennsylvania State University

<Research Interests>

Algorithm Design, Randomized Algorithms

Dongyoun Lee

[Regular member]



- Feb. 2001 : B.S. in Electrical Engineering, Seoul National University
- May. 2008 : M.Phil. in Finance, Columbia Business School
- May. 2012 : Ph.D. in Finance, Columbia Business School
- Mar. 2015 ~ current : Assistant Professor, College of Business Administration, Kookmin University

<Research Interests>

Empirical Asset Pricing, Behavioral Finance