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RECOMMENDING MAJORS TO STUDENTS BY USING FUZZY SIMILARITY

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Outline

- Introduction
- How to help the students for suitable major choice?
 - > Problem statement
- How to suggest the majors
 - > Top-N recommendation
 - Data collection
 - Fuzzy similarity
- Experiment

Introduction

- Even **internet** and **computer** are:
 - > everywhere
 - > growing rapidly
 - > price getting cheaper
- But still there is considerable number of students in the world with no computer and no access to internet at home which makes the learning using internet for such groups is a difficult task.















- Young people in high schools and collages make critical decisions regarding what to study and which career path to pursue.
- Many of them end up switching to other majors because of mismatching major choice and lack of processing information through the professional study.
 - Such changes are wasteful in time and resources and they produce emotional and economical stresses.

Problem Statement

- In order to help **students in major choice**, it is essential to build the **major recommendation** system for the student with a capacity **to meet all the needs**
 - where it provide direction and guidance to students in choosing a major that suits with their interest, learning style and personality.

• Participants

> 107 Mongolian students of 11th grade participated in this study.

- Occupational Information Network (O*NET):
 - O*NET is a free online database containing hundreds of occupational definitions of work and worker characteristics, which are needed for the particular work.
 - > A version 19.0 of O*NET in MySQL is utilized in this study.
 - Each occupations have 6 factors of vocational interests ranging from 1 to 7.

- Measures
 - > Personality Big Five Inventory (BFI)
 - The BFI has the 44 items with responses made on a Likert scale format ranging from 1 = strongly disagree to 5 = strongly agree.



• Measures

- Index of Learning style (ILS).
- self-scoring questionnaire with 44 items for measuring preferences on four dimensions.
- > Active/Reflective
- Sensing/Intuitive
- > Visual/Verbal
- » Sequential/Global

Active learners tend to	Reflective learners prefer to							
 Understand information 	 Think about it quietly 							
best by doing something	first.							
active with it.	 Working alone. 							
 like group work more 								
Sensing learners tend to	Intuitive learners tend to							
 Like learning facts and 	 Work faster and to be 							
good at memorizing.	more innovative.							
 Be patient with details. 	 Discovering possibilities 							
Be more practical and	and relationships.							
careful.								
Visual learners remember best	Verbal learners get more out							
what they see pictures,	of words written and spoken							
diagrams, flow charts.	explanations.							
Sequential learners tend to	Global learners tend to							
Gain understanding in	 learn in large jumps, 							
linear steps logically.	 Absorbing material 							
 Follow logical stepwise 	almost randomly without							
paths in finding	connections, and then							
solutions.	suddenly "getting it."							

- Measures
 - > Vocational Interest:

Holland code model (RIASEC)

 Holland code model has the 106-item with responses made on a 5point scale (strongly dislike to strongly like). Holland code is divided six types.



INVESTIGATIVE

Occupation Description - 974

			-						1
etsoc_code	title	description		R	I.	Α	S	E	С
11-1011.00	Chief Executives	Determine and formulate policies and provide coordinate operational activities at the higher	e overall direction of companies or private and put st level of management with the help of subordina	1.33	2.00	2.67	3.67	7.00	5.33
11-1011.03	Chief Sustainability Officers	Communicate and coordinate with managem	ent, shareholders, customers, and employees to a	1.00	4.33	2.67	2.33	7.00	4.33
11-1021.00	General and Operations Managers	Plan, direct, or coordinate the operations of human resources, but are too diverse and ge	public or private sector organizations. Duties and ı eneral in nature to be classified in any one functior	1.33	1.33	1.00	3.33	7.00	3.67
11-1031.00	Legislators	Develop, introduce or enact laws and statute	es at the local, tribal, State, or Federal level. Inclu	1.00	3.67	3.67	4.67	7.00	3.00
11-2011.00	Advertising and Promotions Managers	Plan, direct, or coordinate advertising policie for a department, an entire organization, or o	es and programs or produce collateral materials, su on an account basis.	1.67	2.00	5.33	2.33	7.00	4.67
11-2011.01	Green Marketers	Create and implement methods to market gr	een products and services.	1.00	5.33	4.33	2.33	5.33	3.00
11-2021.00	Marketing Managers	Plan, direct, or coordinate marketing policies strategies with the goal of maximizing the fir products and services.	and programs, such as determining the demand i m's profits or share of the market while ensuring t	1.00	2.33	3.67	2.67	7.00	5.33
11-2022.00	Sales Managers	Plan, direct, or coordinate the actual distribu programs for sales representatives. Analyze	tion or movement of a product or service to the cu sales statistics gathered by staff to determine sa	3.00	2.00	2.00	3.67	7.00	4.67
11-2031.00	Public Relations and Fundraising Managers	Plan, direct, or coordinate activities designed activities to solicit and maintain funds for sp	d to create or maintain a favorable public image or ecial projects or nonprofit organizations.	1.33	1.33	5.00	3.67	7.00	3.67
11-3011.00	Administrative Services Managers	Plan, direct, or coordinate one or more admin other office support services.	nistrative services of an organization, such as rec	2.00	2.33	1.00	2.67	7.00	5.33
11-3021.00	Computer and Information Systems Managers	Plan, direct, or coordinate activities in such	fields as electronic data processing, information s	4.00	4.33	1.67	1.67	6.67	5.33
11-3031.01	Treasurers and Controllers	Direct financial activities, such as planning,	procurement, and investments for all or part of an	1.67	2.67	1.00	2.67	6.00	7.00
11-3031.02	Financial Managers, Branch or Department	Direct and coordinate financial activities of w	vorkers in a branch, office, or department of an est	1.67	1.67	1.33	3.33	7.00	5.00
11-3051.00	Industrial Production Managers	Plan, direct, or coordinate the work activities	and resources necessary for manufacturing prod	2.67	2.33	1.33	3.33	7.00	6.00
11-3051.01	Quality Control Systems Managers	Plan, direct, or coordinate quality assurance	programs. Formulate quality control policies and (4.33	3.33	1.33	2.00	7.00	5.67
11-3051.02	Geothermal Production Managers	Manage operations at geothermal power gen	eration facilities. Maintain and monitor geothermal	3.67	3.33	2.00	1.67	7.00	5.67
11-3051.03	Biofuels Production Managers	Manage biofuels production and plant operat	ions. Collect and process information on plant pro	4.00	3.33	1.33	2.00	7.00	5.67
11-3051.04	Biomass Power Plant Managers	Manage operations at biomass power genera	ation facilities. Direct work activities at plant, inclu	5.00	3.00	1.33	2.00	7.00	5.67
11-3051.05	Methane/Landfill Gas	Direct daily operations, maintenance, or repa	air of landfill gas projects, including maintenance c	4.67	3.00	1.67	1.33	5.33	6.67

Student info - 107

studentID	lastname	firstname	Realistic	Investigative	Artistic	Social	Enterprising	Conventional	gender	grade
669	Мягмаржав	Arvijakh	3.74	2.81	4.06	4.10	3.63	3.67	эм	103
673	Баатар	Sanduijav	3.32	3.69	3.18	3.60	2.95	3.73	эр	10и
677	Урантөгс	Altansarnai	3.37	3.88	3.76	3.75	3.21	3.53	эм	103
681	Эрдэнэбат	Sergelenbaatar	3.95	3.69	3.41	3.90	3.53	3.73	эр	11и
685	Дашдорж	Norjmaa	3.53	3.81	3.94	4.40	3.42	3.73	эм	103
689	Бат-Орших	Khulan	2.68	2.88	3.82	3.40	3.47	2.73	эм	11и
693	Дугарсүрэн	Gandolgor	2.74	3.69	4.29	4.10	3.79	3.60	эм	11и
697	Мэндбилэг	Lkhamsuren	3.16	2.56	3.24	3.50	2.79	3.67	эм	103
701	Б	Narangua	4.53	4.63	4.65	4.85	4.05	4.40	эм	12a
705	Жамсранжав	Munkhbat	3.63	4.50	3.88	4.50	4.00	3.27	эр	10ж
709	Дашдэмбэрэл	Enkhzul	3.79	4.00	4.12	4.40	4.00	3.67	эм	10и
713	Нямсүрэн	Azjargal	3.53	3.88	4.06	4.45	4.00	4.27	эм	10и
717	Мягмаржав	Khongorzul	3.37	3.63	3.47	3.60	2.84	3.67	эм	10и
721	Пүрэвням	Byambasuren	2.95	3.69	3.47	3.80	3.47	3.47	эр	11г
725	Ганболд	Uulungoo	3.53	3.56	4.18	4.35	3.95	3.53	эм	103
729	Отгонбаяр	Oyunsuren	3.26	3.38	3.94	3.85	3.84	3.80	эм	10и
733	Б	Tseveendulam	4.16	3.56	3.71	4.25	3.89	4.13	ЭМ	12a
737	Гүррагчаа	Enkhzul	3.84	4.19	4.65	4.60	4.26	4.13	эм	10в
741	Ганханд	Uyanga	3.79	3.69	3.94	4.00	3.63	3.87	эм	11ō
745	Оюунцэцэг	Amarzaya	4.58	4.31	4.53	4.65	4.16	4.47	эм	11ō
749	Пүрэв	Enkhjargal	3.79	3.38	4.41	4.15	3.79	3.67	эм	10в
753	Ганболд	Altansukh	4.47	3.88	4.12	4.35	3.74	4.13	эр	11ō
757	Г	Dulmaa	3.42	4.50	4.41	4.75	3.79	3.87	эм	11ō
761	Баттүвшин	Baasantsend	3.68	3.81	4.12	3.75	3.16	3.53	эм	11ō
765	Галхүү	Bayarmagnai	3.95	3.25	3.24	3.60	3.42	3.40	эр	11ō

Architecture

• Major Recommender System (MRS) is a website to assist students in exploring the majors.



Normalizing Data

 we converted those scores into fuzzy values in range [0,1] that can be representing in graphical view which is a membership function using Trapezoid function.



Fuzzy Similarity

$$sim(i,j) = \frac{\sum_{k=1}^{m} \min(x_{ik}, x_{jk})}{\sum_{k=1}^{m} \max(x_{ik}, x_{jk})}$$
(2)

Where j = 1,..,n n = total numbers of occupation m = number of factors in vocational interest j = is the current student x_i, x_j =Scores of student and occupation in interest sim(j, j) = Result of pair wise comparison [1-3]

System Interface

Rec	What're you looking for ?
Result: Key	word = ' architect'
Architectural	and Engineering Managers
Software Dev	elopers, Applications
Computer Sy	<u>stems Engineers/Architects</u>
Database Arc	chitects
Architects, Ex	cept Landscape and Naval
Landscape A	rchitects
Marine Engir	ieers
Marine Archi	tects
Architectural	Drafters
Architecture	Teachers, Postsecondary
Sales Repres	entatives, Wholesale and Manufacturing, Except Technical and Scientific Produc

15-1199.02 Computer Systems Engineers/Architects

What they do - Description

Design and develop solutions to complex applications problems, system administration issues, or network

Knowledge

concerns. Perform systems management

Tasks:

- · Communicate with staff or clients to un
- Provide advice on project costs, design
- Document design specifications, installa
- · Verify stability, interoperability, portabil
- Collaborate with engineers or software

Skills

Active Listening - Giving full attention to what other people are saying, taking time to understand the points being ma questions as appropriate, and not interrupting at inap times.

Critical Thinking - Using logic and reasoning to identify strengths and weaknesses of alternative solutions, cor approaches to problems.

Reading Comprehension - Understanding written sent paragraphs in work related documents.

Related Majors

Computers and Electronics - Knowledge of circuit boards,

and software, including applications and programming.

Engineering and Technology - Knowledge of the practical

processors, chips, electronic equipment, and computer hardware

application of engineering science and technology. This includes

applying principles, techniques, procedures, and equipment to the

15-1143.00 Computer Network Architects

Abilities

Oral Comprehension - The ability to listen to and understand information and ideas presented through spoken words and sentences.

Problem Sensitivity - The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

Oral Expression - The ability to communicate information and ideas in speaking so others will understand.

Interests

Interest code - IRC

Realistic - Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.

> - Investigative occupations frequently involve working nd require an extensive amount of thinking. These can involve searching for facts and figuring out entally.

Required Level of Education

Job Zone Four: Considerable Preparation NeededMost of these occupations require a four-year bachelor's degree, but some do not.

Bachelor's Degree <mark>- 60.87%</mark>

Post-Secondary Certificate - awarded for training completed after high school (for example, in Personnel Services, Engineeringrelated Technologies, Vocational Home Economics, Construction Trades, Mechanics and Repairers, Precision Production Trades) -**13.04%**

Some College Courses - 8.70%

System Interface



Figure 2. Representations of BFI, LSI, and HC model's Factors

Result

studentID: 1098 Intended major: Internists, General

Recommendation list using Fuzzy similarity

Occ_ID	Title			R	I	А	S	E	С				
11-9039.02	Fitness and	tness and Recommendation list using Pearson similar							1				
17-2161.00	Nuclear Eng	uclear Eng											
19-3091.02	Archeologis	Occ_ID	Title	R	I	A	S	E	С				
33-3021.03	Criminal Inv	25-2011.00	Preschool Teachers, Except	0.17	0.28	0.78	1.00	0.39	0.17				
15-1133.00	Software De	25-2053.00	Special Education Teachers	0.22	0.39	0.67	1.00	0.39	0.28				
49-9095.00 Manufactur Installers	29-1125.00	Recreational Therapists					0.45	0.61	1.00	0.39	0.22		
	Installers	25-3021.00	Self-Enrichment Education Teachers					0.28	0.72	1.00	0.50	0.17	
49-3031.00 Bus and Tru		19-1031.03	Park Naturalists					0.45	0.56	1.00	0.45	0.11	
51-6064.00	Textile Winc	21-1011.00	Substance Abuse and Behavioral Disorder Counselors				0.06	0.50	0.56	1.00	0.33	0.17	
49-2092.00	Machine Set Electric Mot	25-2032.00	Career/Technical Education School	Teache	ers, Seco	ondary	0.39	0.45	0.45	1.00	0.45	0.28	
51-9011.00	Chemical Ec	25-2022.00	5-2022.00 Middle School Teachers, Except S Career/Technical Education				0.22	0.39	0.67	1.00	0.39	0.33	
error: R:0.184, I:0.129, A:0, Total error: 0.09683333333		25-1121.00	Art, Drama, and Music Teachers, Postsecondary		0.39	0.45	0.89	0.95	0.28	0.28			
		25-1031.00	Architecture Teachers, Postsecondary				0.39	0.33	0.72	1.00	0.22	0.28	

error: R:0.423, I:0.323, A:0.133, S:0.145, E:0.341, C0.391

Total error: 0.29266666666667

