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Computing Complexity of Cultures

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What is culture: In my case





Hofstede (1984): "the collective programming of the mind which distinguishes the members of one category of people from another"

Tajfel, (1970) : Social Identity Theory supposes that "individuals perceive that they belong to a group or not". It means that if an individual perceives that he or she belong to a specific group, he or she is part of the "ingroup"; if not, he or she is part of the "outgroup."

Staub et al. (2002): An individual's values are affected and adjusted by his or her association to other *cultural groups* (e.g. professional, organizational, religious, and other various social groups).

The *virtual onion model* assumes that "the layering of the onion that makes up a person's culture is not a permanent and immutable set of relationships".



Development of advanced relational models





Empirical research design, business application and analysis, ontology application

Identifying cross-cultural mismatches/common grounds and facilitating cross-cultural business communication

Cross-categorization aross borders











Dynamically learning collective ontologies from multiple datasets



Example of the use of IRM on fMRI data



Analysis of conceptualization patterns across groups of people

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Difficulties in Communication



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Our background knowledge and idea of *blouse* could be different !



Conceptualization of four people: Feature association for 29 English words

'bathing suit'

^{29 clothing concepts} Leuven Natural Concept database (De Deyne et al. 2008)

Subject 1: A1 stinks 'bra' 'blouse' 'pants' 'tie' 'shirt' 'hat' 'coat' Subject 2: A2 'ieans' 'tracksuit' 'dress' 'suit' 'boots' 'beanie' 'cap' Subject 3: A3 'pyjamas' 'belt' 'skirt' 'dungarees' 'shoes' 'shorts' 'scarf' Subject 4: A4 'panties' 'socks' 'sweater' 'top' 'pullover' 't-shirt' 'mittens'

258 features for example:

replaced every day men think it is sexy is blown away by the wind was worn especially in the past is given a present worn as free time clothes worn by young people worn by boys worn by kids used in water used to look nicer used as accessory worn with a suit worn by people worn by women worn by business people worn at parties is made in a factory is ironed worn on gala balls worn often worn often on beaches sold in clothes shops worn with assorted shawl looks sportive are a sort of shoes is comfortable is loose is tight prevents being naked

Analysis of subjective conceptualization: application of multi-array IRM (Glückstad, Herlau, Schmidt, Mørup, 2013)









Subjects:

15 employees from Carlsberg UK15 employees from Carlsberg Denmark13 employees from Carlsberg Russia

Method: Online survey on-site



Picture naming test where a subject selects for a specific picture a suitable name from 19 English words: pullover / top / sweater / T-shirt / pants / jeans / shirt / scarf / blouse / skirt / dress / underpants / panties / bra / shorts / tie / coat / jacket / suits

Feature association test where a subject selects relevant features among in total 74 features for each of the above 19 English words.

1/19: 下記の特徴リストに記載されている特徴が、 "underpants"に関連していると判断する場合、チェックボックスをクリックしてください。"underpants"に関連していると思う特徴をいくつでも選んでください。

注意: "underpants"から連想される特徴を選ぶ際には、自らの直感的な感覚にしたがって判断することを心がけてください。

□ 'can be knitted by yourself' 自分で編むこともできる □ 'worn underneath other clothes' 他の衣類の下に着用できる Comes in very handy' 取り扱いが便利 Costs a lot of money' 高価である Idoes up at the back' 背中で留める everybody has it' 誰もが持っている gives a businesslike impression' ビジネスライクな印象を与える worn on the upper part of your body' 上半身に着用 has/have short trouser-legs' 短い脚がついている □ 'has/have a button' ボタンがついている Ican go into the washing-machine'洗濯機に入れることができる Image: Imag Iplain-colour' 無地 □ 'has/have an elasticated waist' ウェストゴムがついている □ 'can be a status symbol' ステイタスシンボル、社会的地位や身分を象徴しうる Image in the service of the ser □ 'not sexy' セクシーではない Image: Imag □ 'thin' 薄い □ 'has/have straps' 肩紐がついている light and airy' 軽くて風通しが良い

beautiful' 美しい black' 黑 Imade of silk' シルク・絹製品 'comfortable' 快適、着心地が良い has/have different patterns or shapes' いろいろなパターンや形がある 🗌 'feminine' 女らしい □ 'for all ages' あらゆる年齢層向け worn if it's warm' 暖かいときに着用 'for formal occasions' フォーマルな機会に着用 Ifun to wear' 着用するのが楽しい has/have long trouser-legs' 長い脚がついている 'worn by women' 女性が着用 given as a present' プレゼントとして人にあげる 🔲 'consists of different pieces' いくつかのアイテムで構成される Image in the interval interval in the interval in the interval □'is/are hygienic' 衛生的 □'is/are long' 長い □ 'worn by young people' 若者が着用 lis/are loose' ルーズ・締りのない感じ Imade of cotton' 綿製品 'chic' シック、上品 Imade of leather' 皮製品 you wear it with a tie' ネクタイと一緒に着用 Inot expensive' 高価ではない popular' 人気がある 'sexy' セクシー □ 'short' 短い □ 'has/have a zip' ジッパー (ファスナー・チャック) がついている □ 'fashionable' おしゃれ □ 'soft' やわらかい 肌触りが良い Imade of synthetic material 合成繊維 □ 'thick' 分厚い □ 'tight' 窮屈な □ 'used outside' 屋外で着用 'trimmed with lace' レースで縁どりされた worn as leisure time clothes' 休日や余暇で着用



Online questionnaire

□'is/are underwear' 下着 Imas/have floral design' 花柄 'used to keep you warm' 身体を保温するために着用 🗌 'white' 白 worn around your neck' 首回りに着用 □ 'worn by boys' 男児が着用 Imade of denim' デニム製品 □ 'for informal occasions' インフォーマルな機会、普段に着用 'worn every day' 毎日着用 □ 'worn if it's cold' 寒いときに着用 'worn by transvestites' 女装好きの男性が着用 colourful' カラフル、華やか worn on top of a T-shirt' Tシャツの上に着用 □ 'made of wool' 羊毛製品 □ 'worn on your legs' 下半身に着用 'worn to work' 仕事で着用 □ 'worn under a skirt' スカートの下に着用 □ 'looks sporty' スポーティーな needs to be hand washed' 要手洗い prevents being naked' 全裸になるのを防ぐ 'protects against the rain' 雨から身を守る protects against the wind' 風から身を守る 'shrinks when washed' 洗うと縮む 'used as accessory' アクセサリー・装飾品として利用 'used on vacation' バケーションで着用 'used to look nicer' 見栄えをよくするために着用 worn at parties' パーティーで着用 □ 'is/are ironed' アイロンされている □'worn by girls' 女児が着用 □ 'uncomfortable' 堅苦しい 着心地が悪い □ 'worn by kids' 子どもが着用 'worn under a sweater' セーターの下に着用 □'worn by men' 男性が着用 worn often' しばしば着用 □ 'worn with a suit' スーツと一緒に着用



Feature association patterns across people for a specific word "TOP"

features

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type, female, 20's, single, Danish

male, 40's, married, Japanese

Multilingual challenges: JP-DA



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Terms and features extracted from domain specific texts (English translation)

Cross-cultural concept mapping based on information receiver's viewpoint

Cross-categorization aross borders JE2 JE3 JA JE5 Jf7 Jf12 Jf1 D1 D2 D3 D4 D5D6 D7 D9 D1 Bayesian Model of Generalization (BMG) Japanese educational system as reasoner's background knowledge

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D2

0.12

0.23

0.03

0.01

D3

0.86

0.46

0.21

0.11

D4....

0.07

0.34

0.14

0.67

D1

0.43

0.12

0.56

0.28

J1

J2

J3

J4....

Learning a structure from concept-concept similarity relations



Examples (features are standardized in English):

J1 "Shogakko (elementary school)" Features "6 years, starting age 6 years old, compulsory education etc.....'

D1 "folkeskole (elementary and lower secondary school)

Features "9 years, starting age 6 years old, compulsory education etc "

n-IRM	$\begin{split} & z^{(1)} \sim \mathrm{CRP}(\gamma^{(1)}), \\ & z^{(2)} \sim \mathrm{CRP}(\gamma^{(2)}), \end{split}$
for all clusters,	$\lambda_{ab} \sim \text{Gamma}(\alpha_0, \text{rate} = \beta_0),$

$z^{(1)}$	\sim	CRP	$(\gamma^{(1)})$
$z^{(2)}$	\sim	CRP	$(\gamma^{(2)})$

n-IRM	$\boldsymbol{z}^{(1)} \sim \operatorname{CRP}(\gamma^{(1)}),$	Japanese concept clusters,			
	$z^{(2)} \sim \operatorname{CRP}(\gamma^{(2)}),$	Danish concep	t clusters,		
for all clusters,	$\lambda_{ab} \sim \text{Gamma}(\alpha_0, \text{rate} = \beta_0),$	precision,	(5)		
for all clusters,	$m_{ab} \sim \operatorname{Normal}\left(m_0, (\kappa_0 \lambda_{ab})^{-1}\right),$	mean,	(6)		
	1				

for all objects, $R_{ij} \sim \text{Normal}(m_{z_i^{(1)} z_j^{(2)}}, \lambda_{z_i^{(1)} z_i^{(2)}}^{-1}), \text{ links (real valued). (7)}$ Similarity between DK-JP concepts >>> sorted by the n-IRM



DK concept clusters D1-D12



concept clusters J1-J13

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Learning more detailed structures from concept-feature relations





Feature clusters f1-f12

Z1 mode (JP concept clusters J1-J13) is fixed in order to learn the feature structures of each concept cluster.

clustering of features, (8) strength of interactions, (9)

links (binary valued). (10)

Sorted by IRM





Visualizing with the FCA (automatic learning of feature structure)



	154	100	150	16.4	100	150	10-	160	160	164.0	164.4	154.5	
-	Jf1	Jt2	Jf3	Jt4	Jt5	Jt6	Jf7	718	Jf9	Jt10	Jt11	Jf12	
	0.04	0.06	0.08	0.02	0.09	0.03	0.96	0.07	0.47	0.11	0.11	0.11	
	0.01	0.73	0.05	0.03	0.05	0.04	0.85	0.07	0.21	0.88	0.88	0.13	
	0.00	0.02	0.02	0.03	0.81	0.04	0.95	0.93	0.50	0.13	0.13	0.13	
	0.00	0.02	0.05	0.92	0.03	0.04	0.95	0.07	0.92	0.13	0.25	0.13	
	0.00	0.04	0.03	0.03	0.97	0.95	0.88	0.08	0.08	0.86	0.14	0.86	
	0.00	0.02	0.03	0.03	0.91	0.05	0.94	0.08	0.08	0.86	0.14	0.86	
	0.05	0.03	0.03	0.04	0.31	0.06	0.93	0.22	0.22	0.67	0.17	0.67	
	0.00	0.07	0.04	0.05	0.95	0.93	0.82	0.88	0.13	0.20	0.20	0.20	
	0.07	0.03	0.30	0.05	0.05	0.07	0.91	0.13	0.63	0.20	0.60	0.20	
	0.00	0.10	0.83	0.50	0.05	0.07	0.82	0.13	0.13	0.20	0.80	0.20	
	0.08	0.14	0.04	0.50	0.05	0.07	0.82	0.13	0.13	0.80	0.60	0.20	
	0.08	0.20	0.06	0.07	0.07	0.10	0.75	0.17	0.17	0.25	0.25	0.25	
	0.03	0.09	0.22	0.13	0.88	0.17	0.80	0.25	0.50	0.33	0.33	0.50	
the n-IRM + the IRM are used for the FCA													
ļ	JE	J13	\times				eL Itt		JT2 J2		J11	× J4	Jr3 J10
							V.						

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Overall context C {G, M, I} defined as G: (J1, J2, ... J13), M: (Jf1, Jf2, Jf12)

Cross-categorization framework

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Collaboration possibilities ?



My interests (based on my strong collaborators in DTU Compute) :

- Application of non-parametric Bayesian models to humanities and social sciences
- Data-driven analysis of cultural dynamics (cross-cultural analysis of human values, attitudes, behaviors through psychological, linguistic and physiological data)
 >> Computing Cultural Complexity Happiness as keyword
- Concept acquisition and categorization across cultures
- Structuring and alignment of knowledge across cultures (ontology learning and alignment, concept mapping across cultures)
- >>> Machine assisted cross-cultural English communication design (Global English communication)
- >>> Machine assisted cross-lingual communication design between remote languages (e.g. Danish-Japanese)

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