Appendix A: Algorithm for GAKCCA

Algorithm 1 Generalized Additive Kernel Canonical Correlation Analysis

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Choose arbitrary vectors $\tilde{\boldsymbol{a}}_{jl'}$ such that below condition holds :

$$\boldsymbol{a}_{jl'}^0 = \left[(1 - \tau_j) \frac{1}{n} \sum_{l=1}^{p_j} \sum_{m=1}^{p_j} \tilde{\boldsymbol{a}}_{jl}^{0T} \widehat{\boldsymbol{K}}_{jl} \widehat{\boldsymbol{K}}_{jm} \tilde{\boldsymbol{a}}_{jm}^0 + \tau_j \sum_{l=1}^{p_j} \tilde{\boldsymbol{a}}_{jl}^{0T} \widehat{\boldsymbol{K}}_{jl} \tilde{\boldsymbol{a}}_{jl}^0 \right]^{(-1/2)} \tilde{\boldsymbol{a}}_{jl'}^0$$

repeat
  for $j \leftarrow 1$ to J **do**
    for $l' \leftarrow 1$ to p_j **do**

$$\boldsymbol{u}_j^{(s)} = \sum_{l=1}^{l'-1} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{a}_{jl}^{(s+1)} + \sum_{l=l'}^{p_j} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{a}_{jl}^{(s)}$$

$$\boldsymbol{z}_j^{(s)} = \sum_{k=1}^{j-1} c_{jk} w \left(\sum_{l=1}^{l'-1} \frac{1}{n} \boldsymbol{a}_{jl}^{T\,(s+1)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{u}_k^{(s+1)} + \sum_{l=l'}^{p_j} \frac{1}{n} \boldsymbol{a}_{jl}^{T\,(s)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{u}_k^{(s+1)} \right) \frac{1}{n} \boldsymbol{u}_k^{(s+1)}$$

$$+ \sum_{k=j+1}^{J} c_{jk} w \left(\sum_{l=1}^{l'-1} \frac{1}{n} \boldsymbol{a}_{jl}^{T\,(s+1)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{u}_k^{(s)} + \sum_{l=l'}^{p_j} \frac{1}{n} \boldsymbol{a}_{jl}^{T\,(s)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{u}_k^{(s)} \right) \frac{1}{n} \boldsymbol{u}_k^{(s)}$$

$$r_j^{(s)} = \sum_{l=1}^{l'-1} \boldsymbol{z}_j^{T\,(s+1)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{z}_j^{(s+1)} + \sum_{l=l'}^{p_j} \boldsymbol{z}_j^{T\,(s)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{z}_j^{(s)}$$

$$s_j^{(s)} = \sum_{l=1}^{l'-1} \boldsymbol{u}_j^{T\,(s+1)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{z}_j^{(s+1)} + \sum_{l=l'}^{p_j} \boldsymbol{u}_j^{T\,(s)} \widehat{\boldsymbol{K}}_{jl} \boldsymbol{z}_j^{(s)}$$

$$\lambda_j = - \left[\frac{1 - \tau_j}{\tau_j} \frac{1}{n} s_j \right] \pm \sqrt{ \left[\frac{1 - \tau_j}{\tau_j} \frac{1}{n} s_j \right]^2 + 4 \frac{1}{\tau_j} r_j }$$

$$\boldsymbol{a}_{jl'}^{(s+1)} = \frac{1}{\tau_j} \frac{1}{\lambda_j^{(s)}} \boldsymbol{z}_j^{(s)} - \frac{1}{n} \frac{1 - \tau_j}{\tau_j} \boldsymbol{u}_j^{(s)}$$

    end for
  end for
until convergence of the criterion;

Appendix B: List of variables in real data

Table 6. Variables and Definitions

Groups	Variables	Definition
Psychosocial group	KRQ:Emotion regulation	Korean Resilience Quotient (3 categories. 9 subscales): Self-Regulation, Master, Positivity
	KRQ:Impulse control	- Self-Regulation = Emotion Regulation + Impulse Control + Causal Analysis
	KRQ:Causal analysis	- Interpersonal Skills = Communication Skills + Empathy + Reaching Out
	KRQ:Communication	- Positivity = Realistic Optimism + Life-Satisfaction + Gratitude
	KRQ:Empathy	
	KRQ:Self-expansion	
	KRQ:Self-positivity	
	KRQ:Life satisfaction	
	KRQ:Appreciation	
	MSSS:SES	MacArthur Scale of Subjective Social Status
	MSSS:Community	
	LES:Frequency of PE	Life Experiences Survey:
	LES:Severity of PE	Frequency of Life Events, Severity of Life events, Intensity of Life Events
	LES:Frequency of NE	
	LES:Severity of NE	
	SSS:Emotional support	Attributes of Social Support: :
	SSS:Evaluative	Emotional, Instrumental, Informational, and Appraisal
	SSS:Information support	
	SSS:Material	
	WHOQOL:Physical	Physical Health, Psychological Health, Social Relationships and Environment
	WHOQOL:Social relationship	
	WHOQOL:Environment	
	IRI:Perspective taking	Perspective Taking (PT), Fantasy (FS),
	IRI:Fantasy	Empathic Concern (EC), and Personal Distress (PD)
	IRI:Empathic concern	
	IRI:Personal distress	
	ULS	Scale for Loneliness
Clinical group	SCIDII:Avoidant	Self-Questionnaire: Personality Disorders
	SCIDII:Dependent	- Cluster A (odd) -Paranoid, Schizoid, Schizotypal
	SCIDII:Obsessive-compulsive	- Cluster B (dramatic)- Antisocial, Borderline, Histrionic, Narcissistic
	SCIDII:Passive-aggressive	- Cluster C (anxious)- Avoidant, Dependent, Obsessive–compulsive
	SCIDII:Depressive	
	SCIDII:Paranoid	
	SCIDII:Schizoid	
	SCIDII:Histrionic	
	SCIDII:Narcissistic	
	SCIDII:Borderline	
	SCIDII:Antisocial	
	SSI-Beck	Scale for Suicide Ideation
	AUDIT-K	Scale for Alcohol Use Disorder
	BAI	Scale for Anxiety
	BDI-II	Scale for Depression
Structural MRI group	T1 volume	T1 - T2 weighted images
	T1/T2	T1 - T2 weighted images (Indicator that indirectly shows the amount of myelin in the cortical grating meter.)
	FA	DTI-Fractional Anisotropy
	MWF	Myelin Water Fraction, ViSTA
Neurodevelopmental group	Age	Physical age
	Years of Education	Total training period in schools
	IQ	Estimated IQ