

Supplementary Information

QSAR Study of the Inhibitors of the Acetyl-CoA Carboxylase 1 and 2 using Bayesian Regularized Genetic Neural Networks: A Comparative Study

Abolfazl Valadkhani,^{*a} Mohammad Asadollahi-Baboli^b and Ahmad Mani-Varnosfaderani^c

^aDepartment of Analytical Chemistry, Chemistry and Chemical Engineering Research Center of Iran, Tehran, Iran

^bDepartment of Science, Babol University of Technology, Babol, Iran

^cDepartment of Chemistry, Tarbiat Modares University, Tehran, Iran

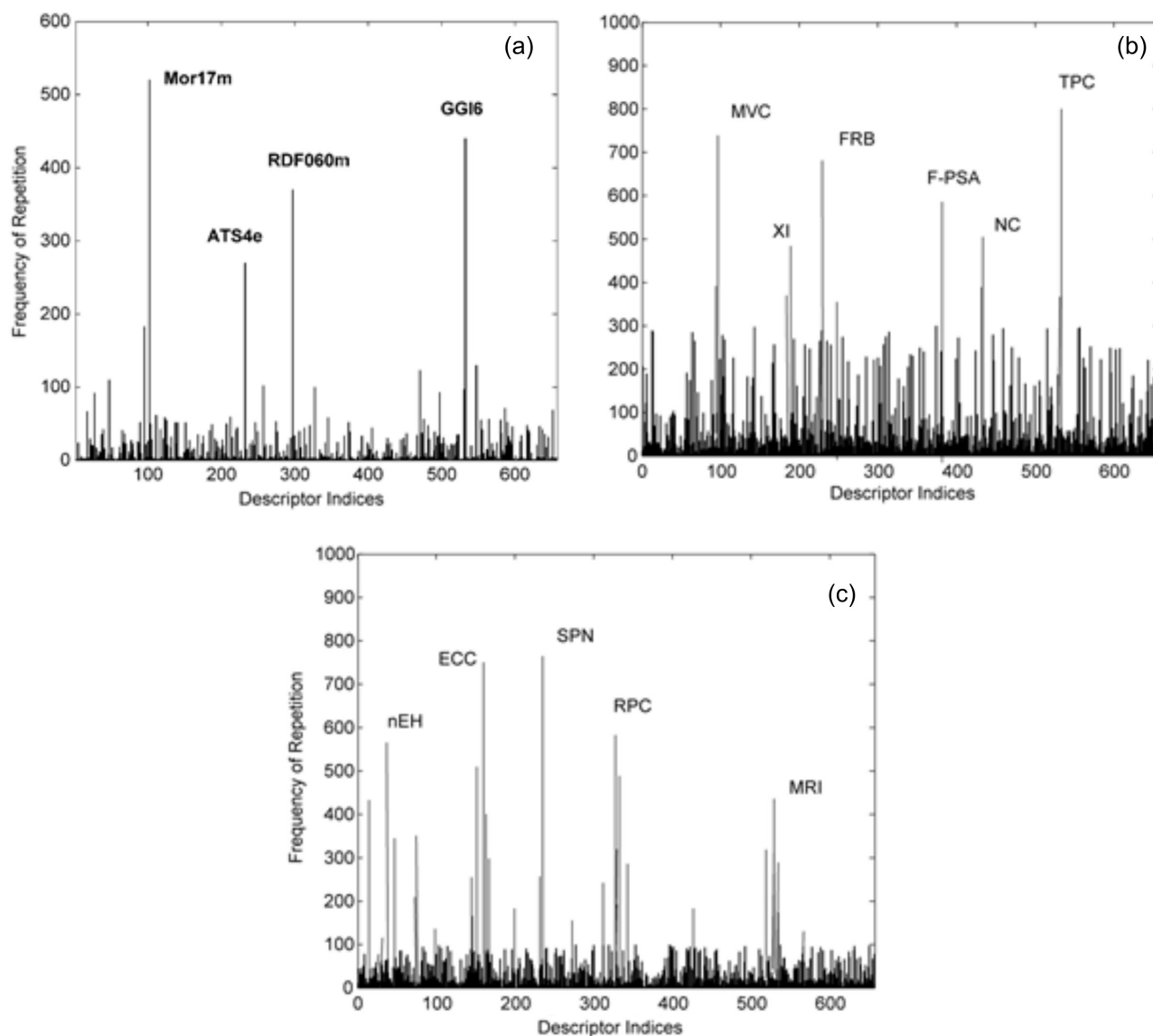


Figure S1. Frequency plot of the molecular descriptors for 1000 times repetition of the BRGNN algorithm. a) rACC1(pIC₅₀) b) hACC2(pIC₅₀) c) rACC1 (LE) as dependent variable.

*e-mail: a_valadkhani@ccerci.ac.ir

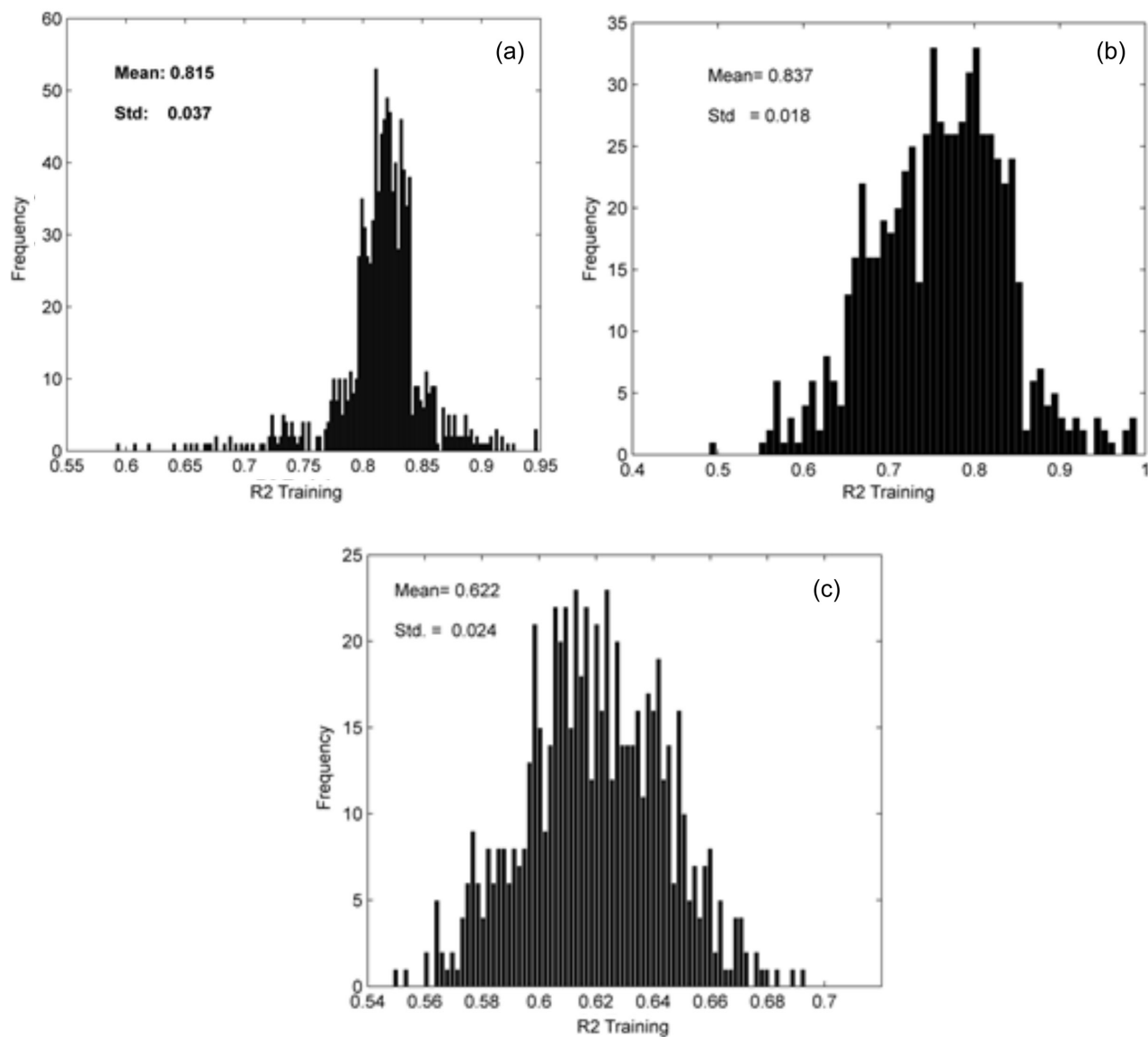


Figure S2. Histogram of the values of R^2_{training} for 1000 times repetition of BRGNN algorithm. a) $r\text{ACC1}(p\text{IC}_{50})$ b) $h\text{ACC2}(p\text{IC}_{50})$ c) $r\text{ACC1}(\text{LE})$ as dependent variable.

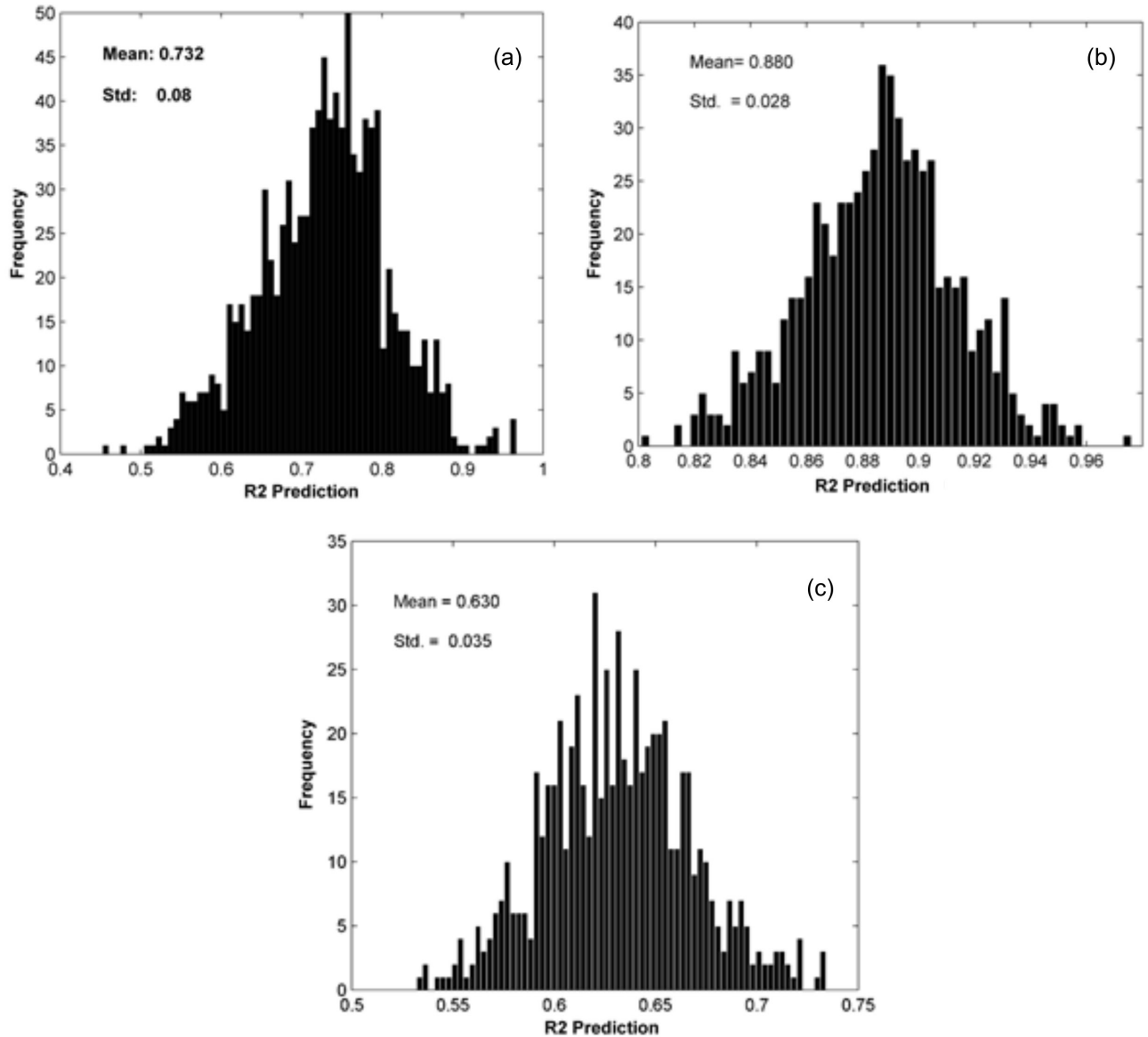


Figure S3. Histogram of the values of $R^2_{\text{prediction}}$ for 1000 times repetition of BRGNN algorithm. a) rACC1(pIC₅₀) b) hACC2(pIC₅₀) c) rACC1 (LE) as dependent variable.

Table S1. Specifications of genetic algorithm (GA) and BRANN parameters applied for the optimization.

GA parameters		BRANN parameters	
Cross over function	Scattered	Maximum number of epochs	100
Mutation rate	0.2	Marquardt adjustment parameter (Mu)	0.005
Migration Interval	20	Decrease factor for Mu	0.1
Migration condition	Forward	Increase Factor for Mu	10
Hybrid Function	Pattern Search	Maximum value for Mu	10 ¹⁰
Number of Generations	200	Minimum performance gradient	10 ⁻¹⁰
Number of Populations	80	Maximum validation failures	5

Table S2. The selected molecular descriptors using linear and non-linear techniques

Dependent Variable	Method	Selected molecular descriptors	Type of descriptor
pIC ₅₀ (rACC1)	Stepwise-MLR	Average eccentricity	Topological descriptors
		Hydrophilic factor	Empirical Descriptors
		Number of acceptor atoms for Hydrogen bonds	Functional group descriptors
		Gutman MTI by valence vertex degrees	Topological descriptors
		Xu index	Topological descriptors
	GA-MLR	Average eccentricity	Topological descriptors
		Hydrophilic factor	Empirical Descriptors
		Number of acceptor atoms for Hydrogen bonds	Functional group descriptors
		Gutman MTI by valence vertex degrees	Topological descriptors
		Xu index	Topological descriptors
	SPA-MLR	Subpolarity parameter (SubP)	Charge descriptors
		Mean of atomic Sanderson Electronegativities (Scaled on Carbon atom) (MSE)	Constitutional descriptors
		Unipolarity (UNiP)	Topological descriptors
		Centralization index (CENT)	Topological descriptors
		3D-Morse signal 12 weighted by atomic electronegativities (Mor12e)	3D- Morse
	BRGNNs	Galvez topological charge index of order 6 (GGI6)	Charge descriptors
		Radial distribution function -06 weighted by atomic masses (RDF060m)	Radial distribution functions
		Broto-Moreau autocorrelation of a topological charge structure lag 4 (ATS4e)	2D- autocorrelation
		3D-Morse signal 17 weighted by atomic masses (Mor17m)	3D- Morse
	pIC ₅₀ (hACC2)	Stepwise-MLR	Number of multiple bonds
Quadratic index			Topological descriptors
Eccentricity index			Topological descriptors
Centralization index			Topological descriptors
Sum of topological distances between Nitrogen and Iodine			Topological descriptors
Total positive charge			Charge descriptors
Number of Hydrogen attached to C (sp ³) with no Halogen attached to next Carbon			Atom-centered fragments
GA-MLR		Quadratic index	Constitutional descriptors
		Eccentricity index	Topological descriptors
		Centralization index	Topological descriptors
		Sum of topological distances between Nitrogen and Iodine	Topological descriptors
		Total positive charge	Charge descriptors
SPA-MLR		Mean of atomic Sanderson Electronegativities (Scaled on Carbon atom)	Constitutional descriptors
		Number of Sulfur atoms	Constitutional descriptors
		Total positive charge (TPC)	Topological descriptors
	Polarity number (Pol)	Topological descriptors	
	Solvation connectivity index (X1sol)	Topological descriptors	
	Unipolarity (UniP)	Topological descriptors	
	Number of Carbon atoms (Nc)	Topological descriptors	
BRGNN	Gutman valence vertex degree (GuD)	Constitutional descriptors	
	Graph vertex complexity index (MVC)	Topological descriptors	
	Number of circuits (NC)	Topological descriptors	
	Fragment-based polar surface area (F-PSA)	Constitutional descriptors	
	Rotatable bond fraction (FRB)	Property descriptors	
	Xu index (XI)	Constitutional descriptors	
LE (rACC1)	Stepwise-MLR	Total positive charge (TPC)	Charge descriptors
		Unsaturation index	Empirical descriptors
		Mean electrotopological state	Constitutional descriptors
		Average molecular weight	Constitutional descriptors
		Mean absolute charge	Charge descriptors
		Mean of atomic polarizabilities (Scaled on Carbon atom)	Constitutional descriptors

Table S2. The selected molecular descriptors using linear and non-linear techniques (cont.)

Dependent Variable	Method	Selected molecular descriptors	Type of descriptor
LE (rACC1)	GA-MLR	Total squared charge	Charge descriptors
		Local dipole index	Charge descriptors
		Asphericity index	Topological descriptors
		Mean topological charge index of order 1	Galvez charge descriptors
		Average molecular weight	Constitutional descriptors
	SPA-MLR	Mean absolute charge	Charge descriptors
		Distance-Detour index (DDI)	Topological descriptors
		Solvation connectivity index of order 1 (X1Sol)	Topological descriptors
		Number of X--C bond on aromatic ring (C-044)	Functional groups descriptors
		Mean of atomic Sanderson Electronegativities (Scaled on Carbon atom) (MSE)	Constitutional descriptors
	BRGNN	Relative positive charge (RPC)	Charge descriptors
		Molar refractive index (MRI)	Empirical descriptors
		Number of ethers (aliphatic) (nEH)	Functional group descriptors
		Spanning tree number (SPN)	Topological descriptors
		Eccentricity (ECC)	Topological descriptors
		Relative positive charge (RPC)	Charge descriptors