ANN-based prediction of equilibrium gas composition and carbon yield in methane pyrolysis and reforming methods

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Figures 1-15 present parity plots for all cases listed in Table 2 of the article.

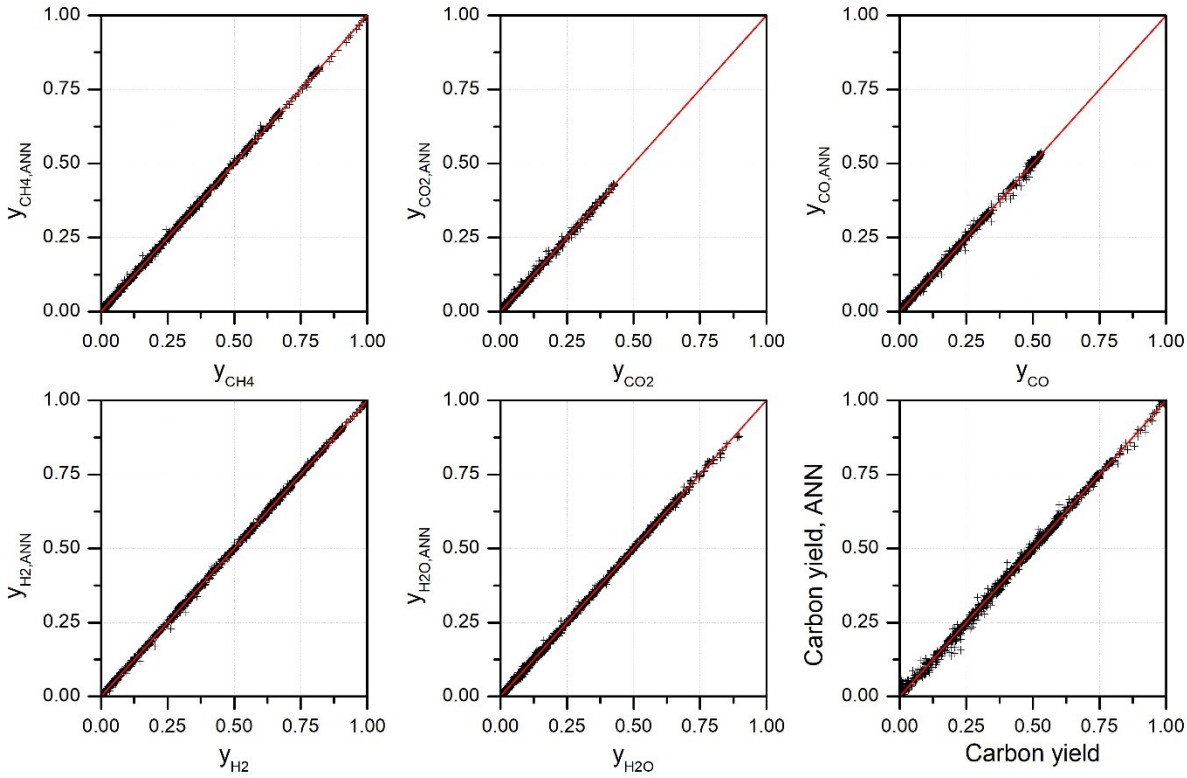

Fig. 1. Comparison of the ANN predictions and targets for training/testing set No. 1 (see Table 2 in the article).

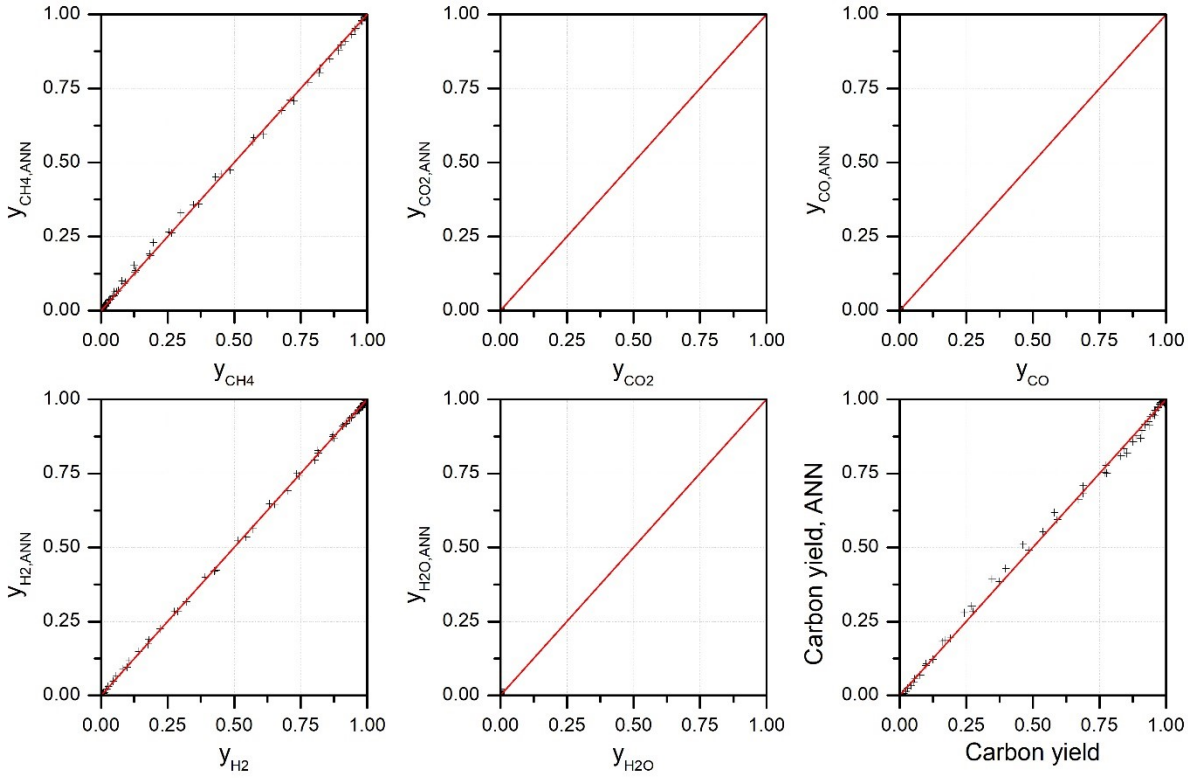

Fig. 2. Comparison of the ANN predictions and targets for testing set No. 2.1 (see Table 2 in the article).

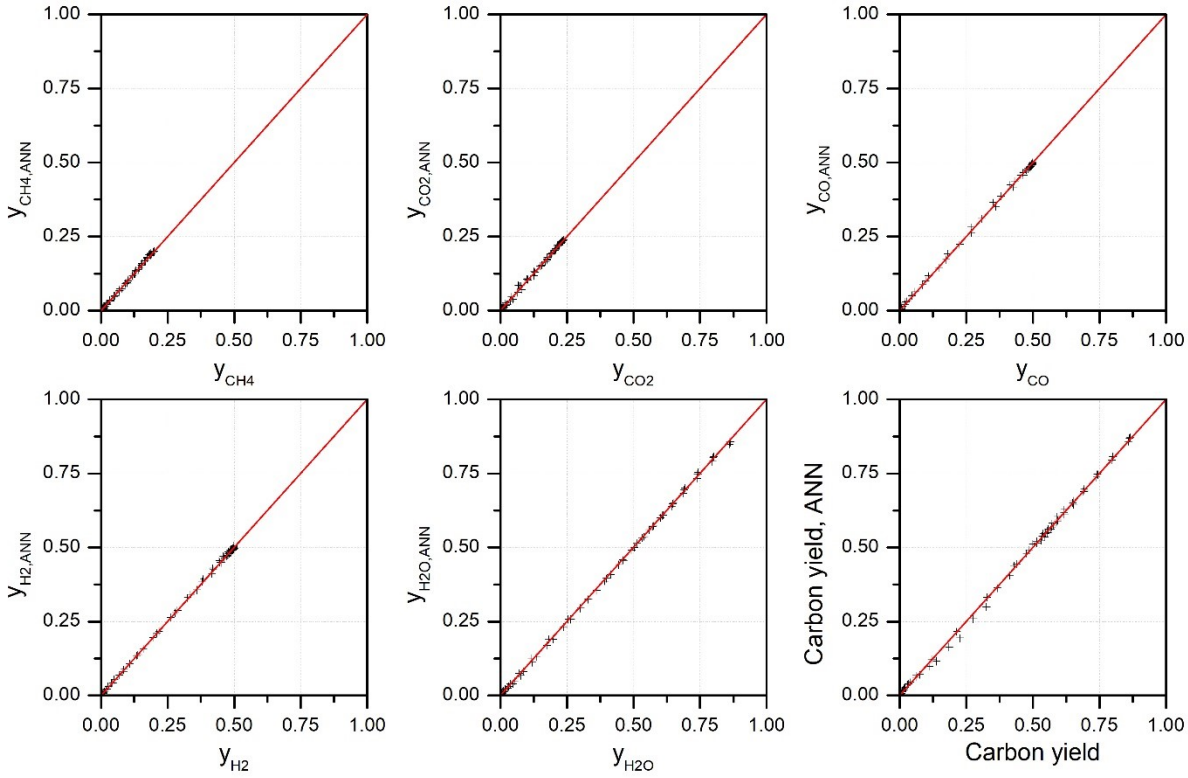

Fig. 3. Comparison of the ANN predictions and targets for testing set No. 2.2 (see Table 2 in the article).

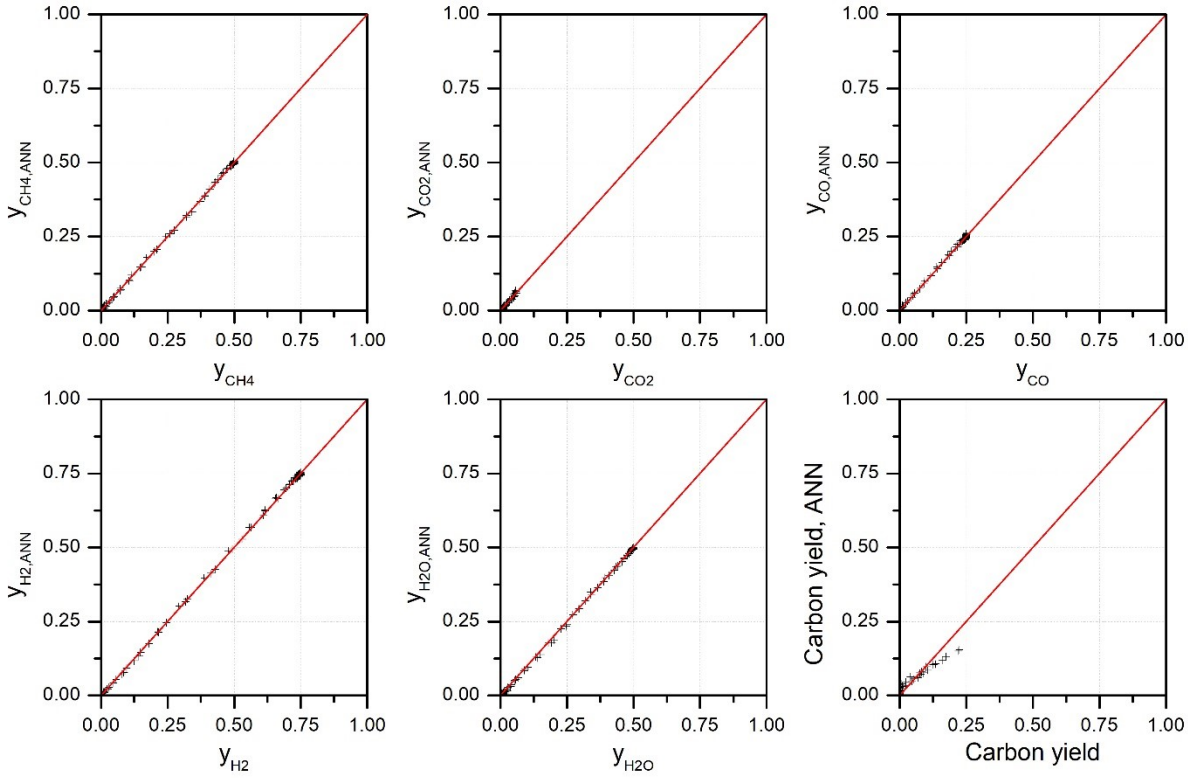

Fig. 4. Comparison of the ANN predictions and targets for testing set No. 2.3 (see Table 2 in the article).

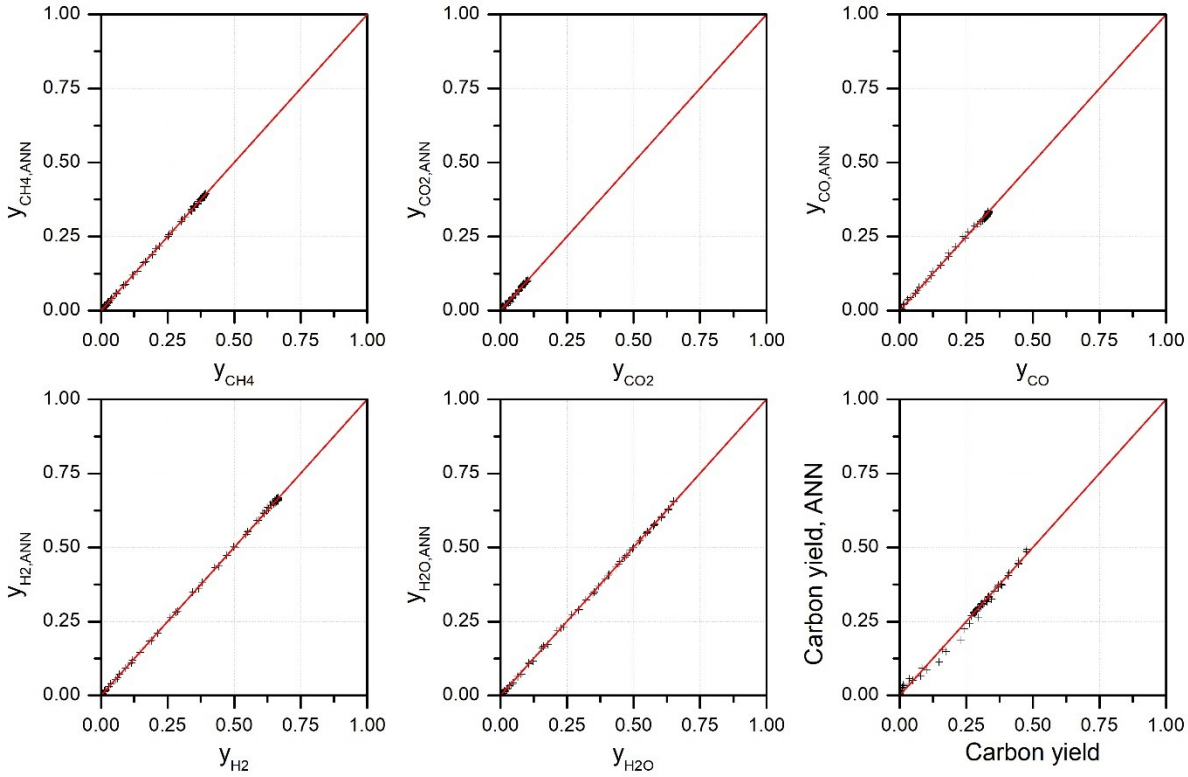

Fig. 5. Comparison of the ANN predictions and targets for testing set No. 2.4 (see Table 2 in the article).

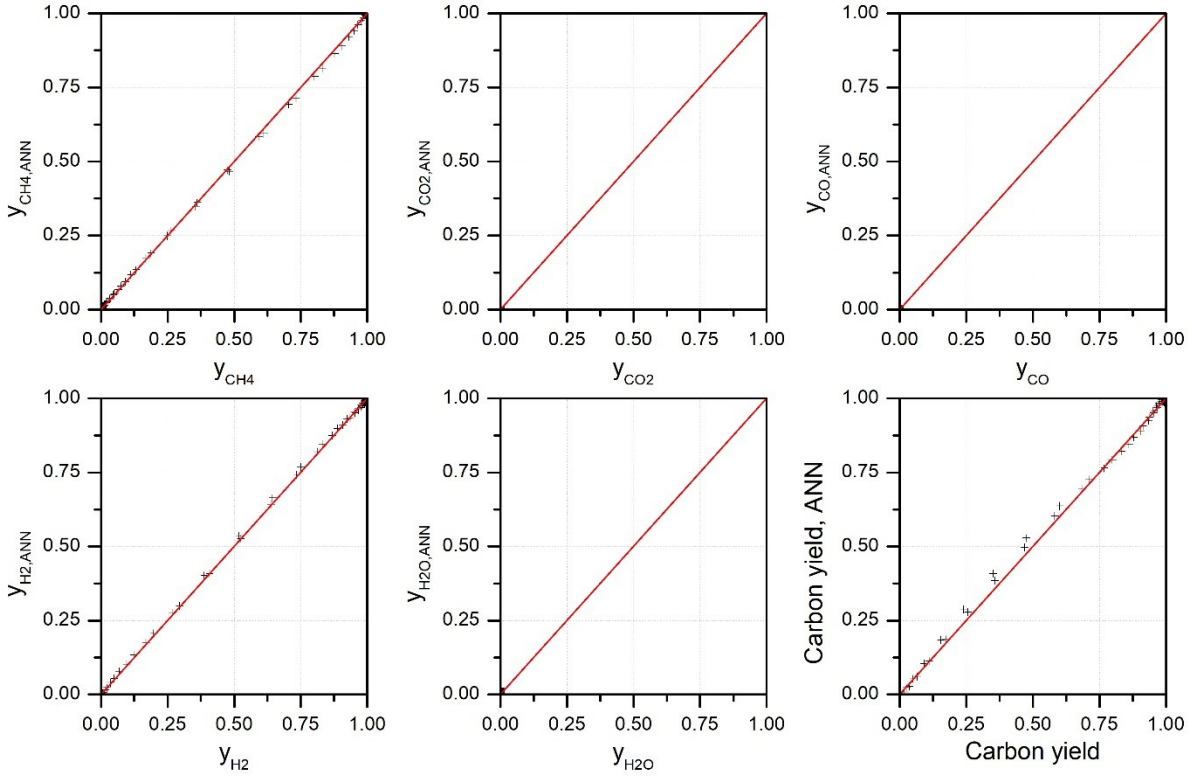

Fig. 6. Comparison of the ANN predictions and targets for testing set No. 3.1 (see Table 2 in the article).

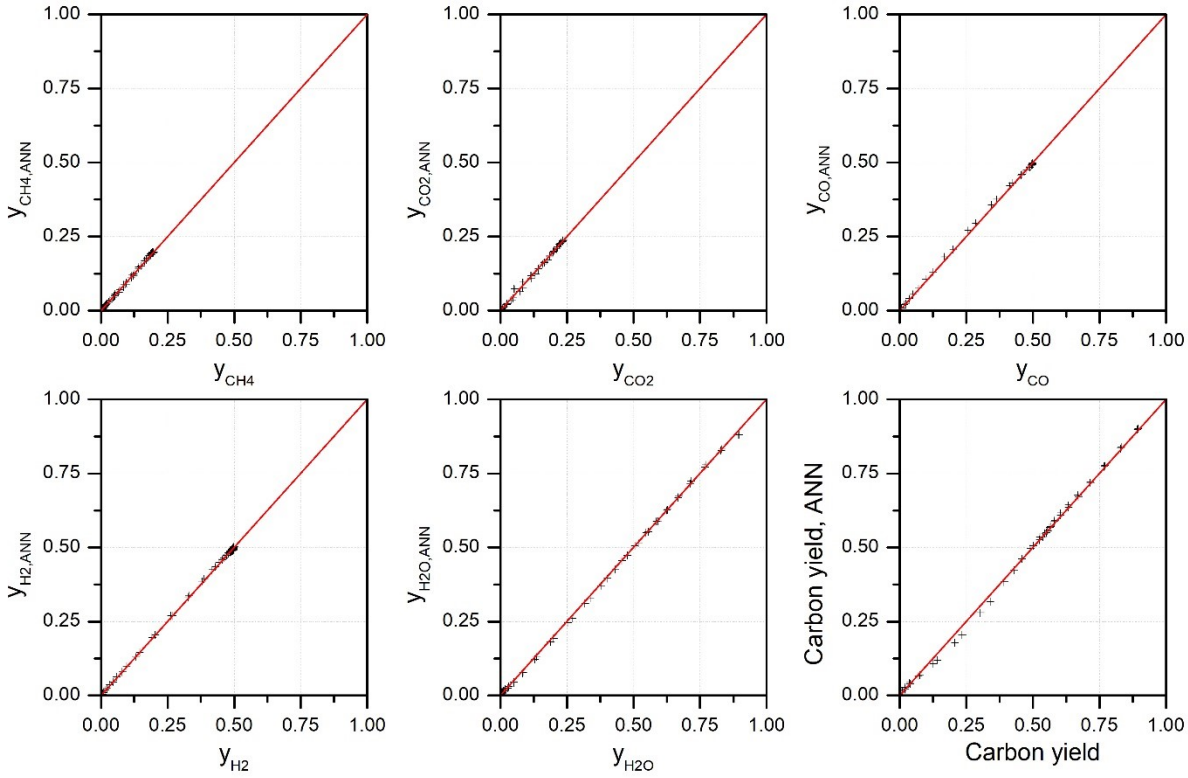

Fig. 7. Comparison of the ANN predictions and targets for testing set No. 3.2 (see Table 2 in the article).

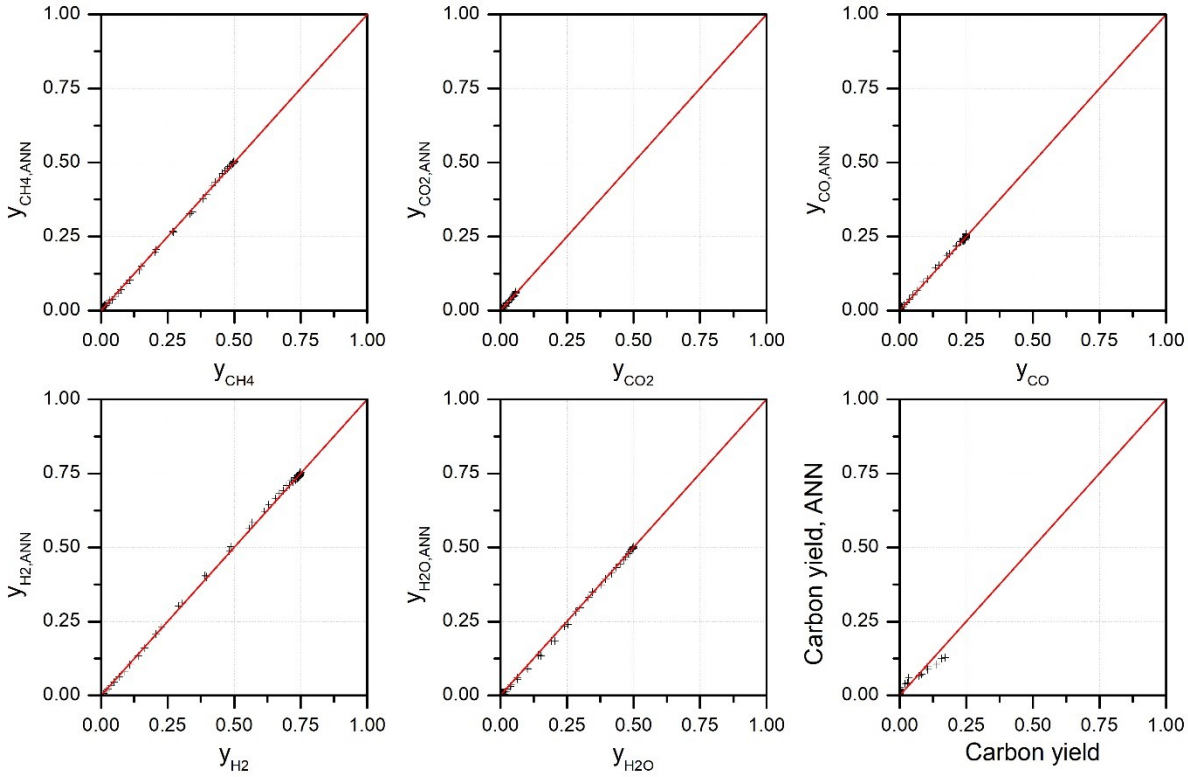

Fig. 8. Comparison of the ANN predictions and targets for testing set No. 3.3 (see Table 2 in the article).

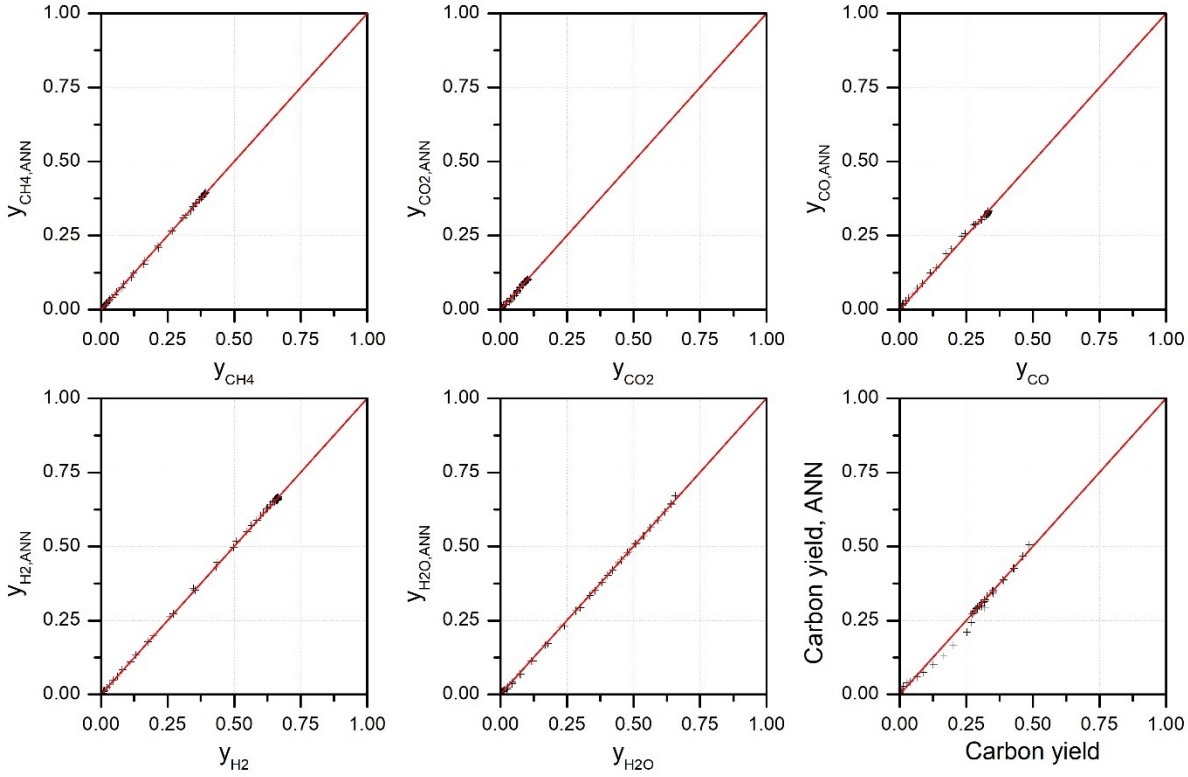

Fig. 9. Comparison of the ANN predictions and targets for testing set No. 3.4 (see Table 2 in the article).

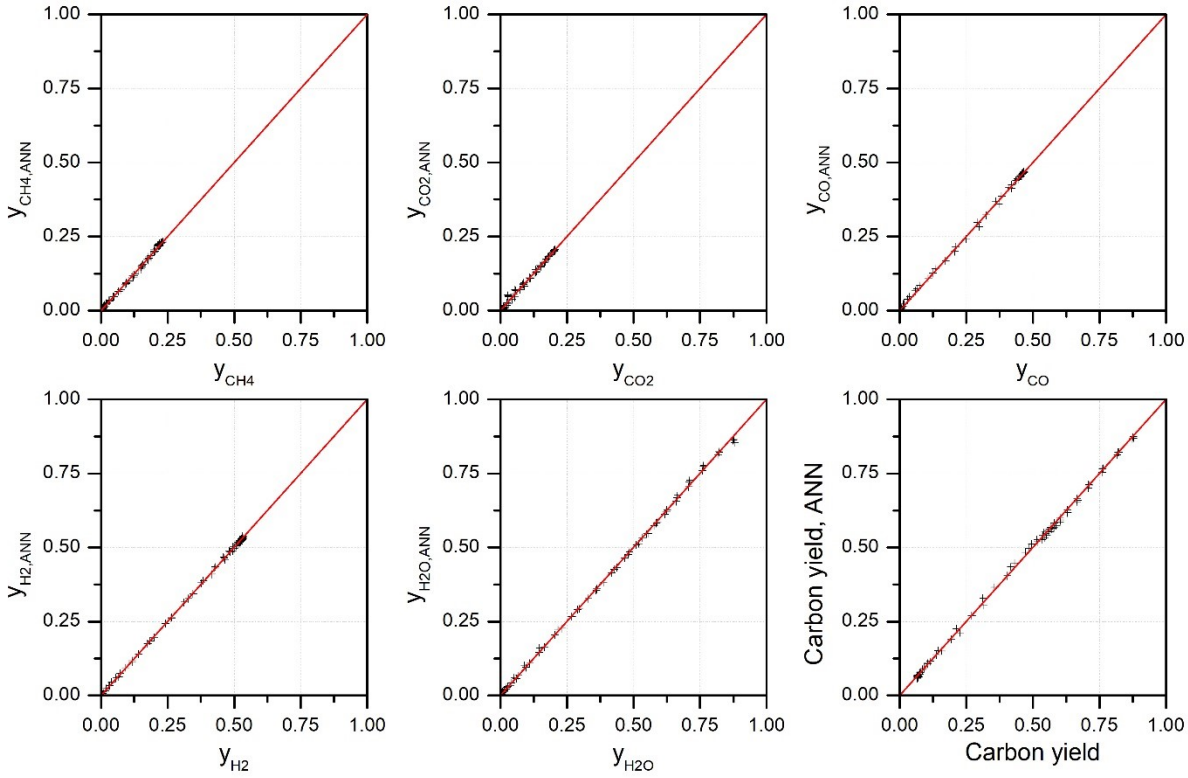

Fig. 10. Comparison of the ANN predictions and targets for testing set No. 4.1 (see Table 2 in the article).

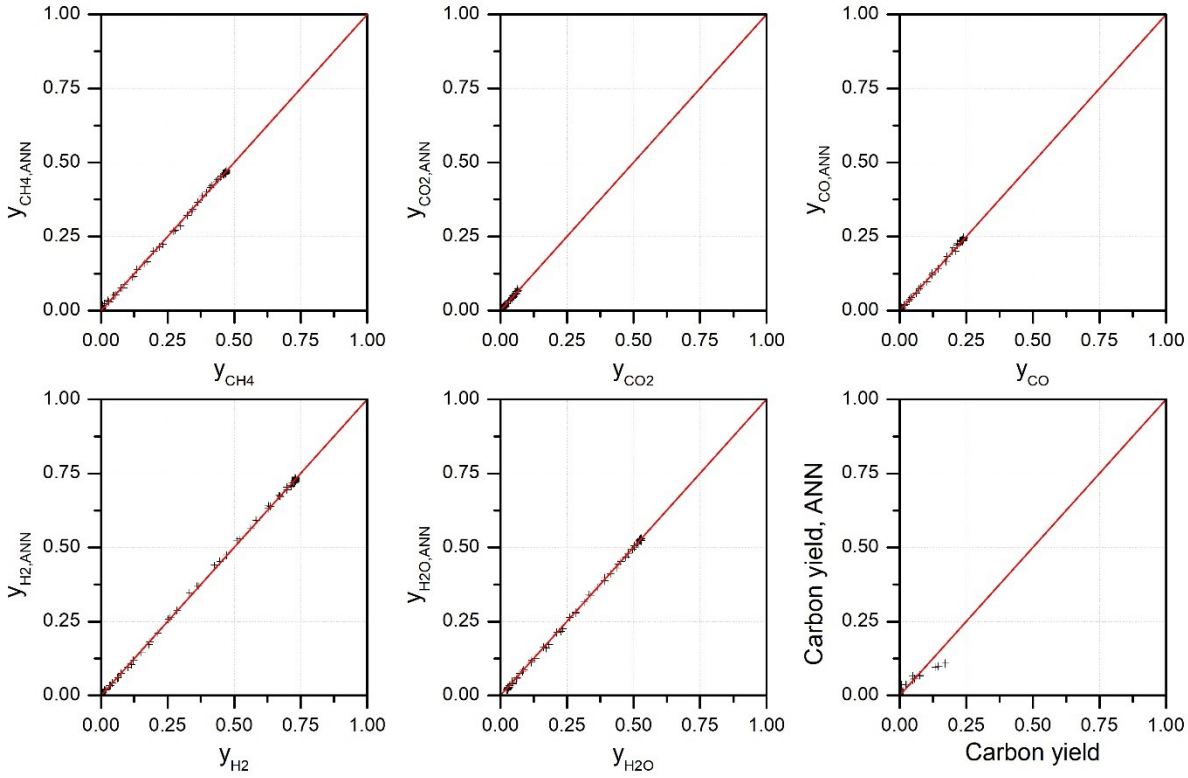

Fig. 11. Comparison of the ANN predictions and targets for testing set No. 4.2 (see Table 2 in the article).

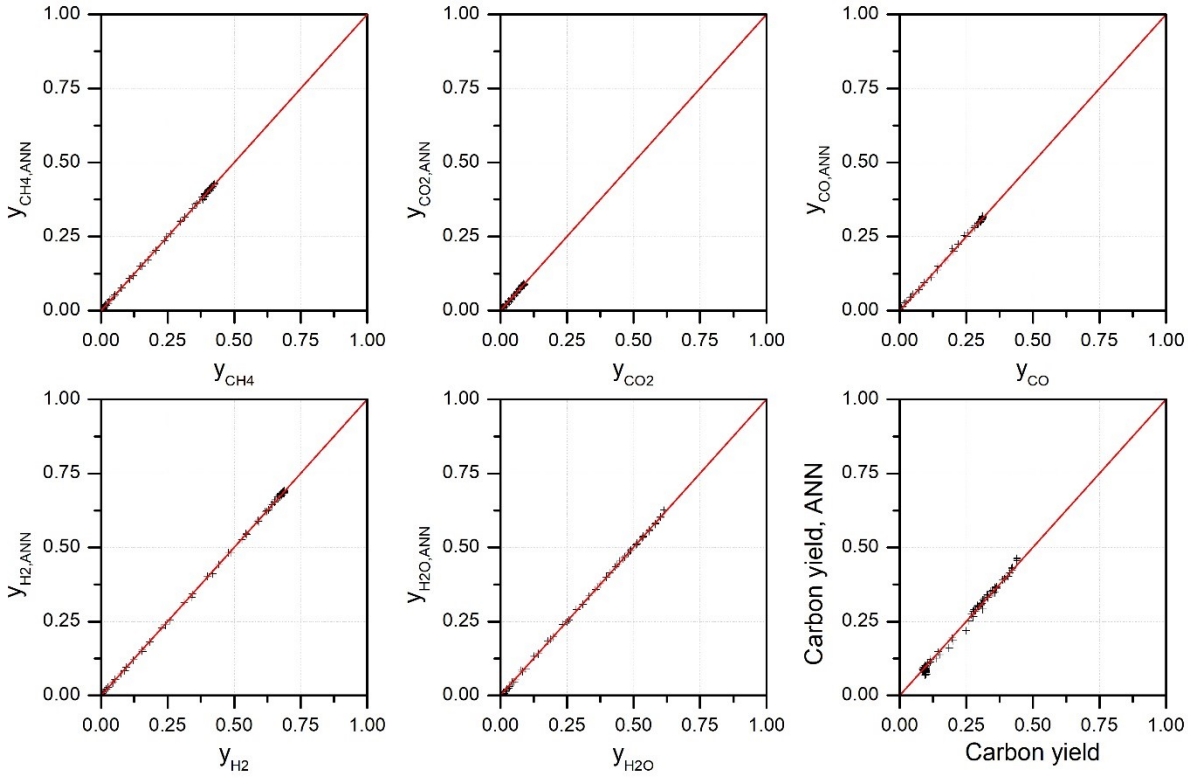

Fig. 12. Comparison of the ANN predictions and targets for testing set No. 4.3 (see Table 2 in the article).

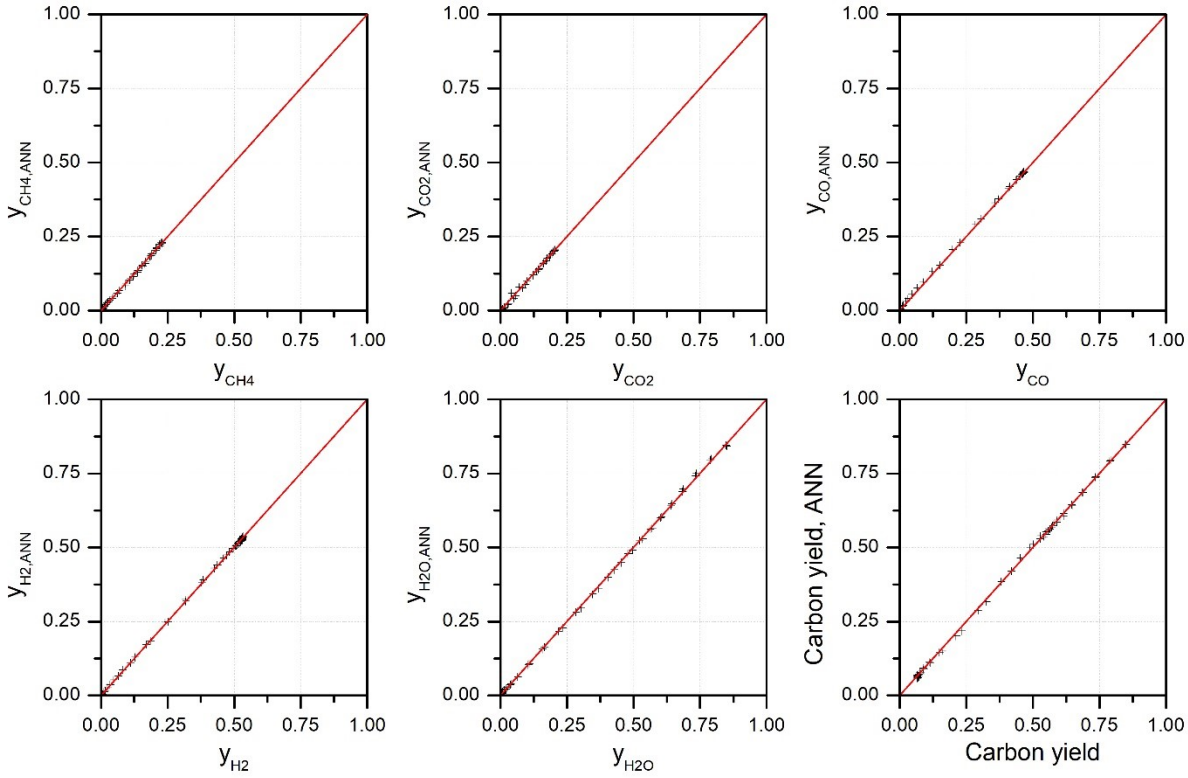

Fig. 13. Comparison of the ANN predictions and targets for testing set No. 5.1 (see Table 2 in the article).

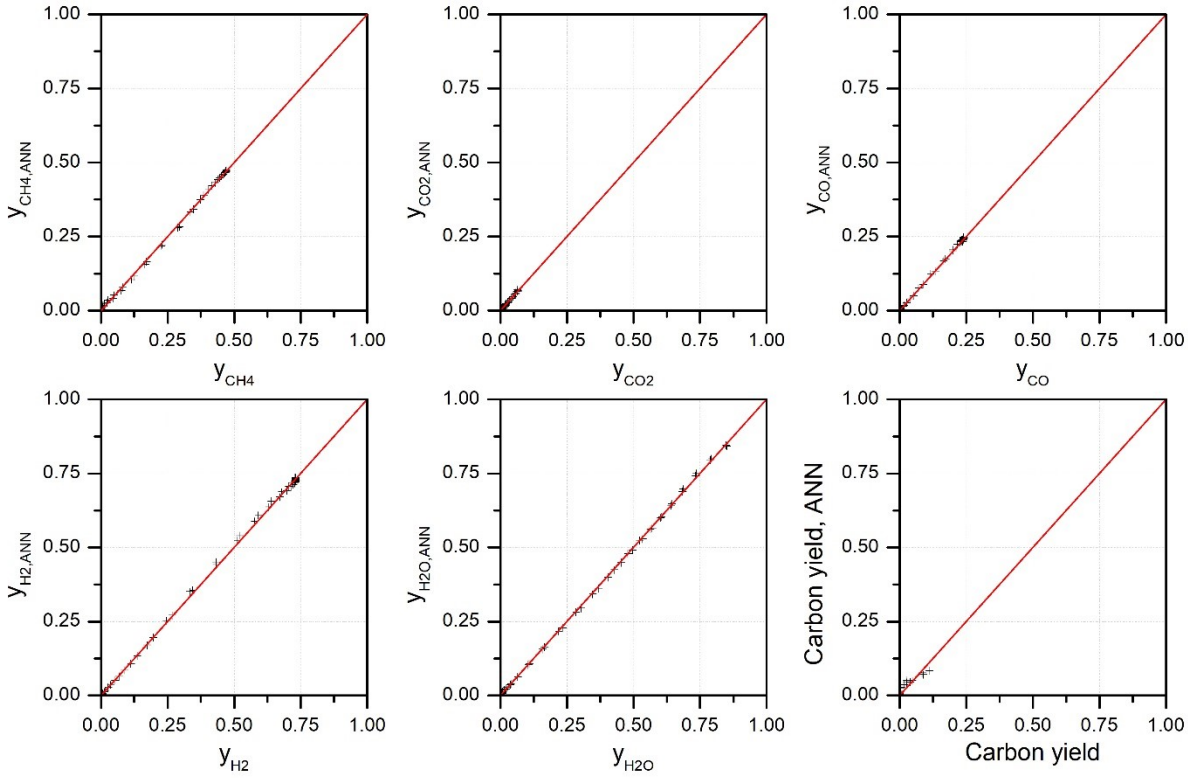

Fig. 14. Comparison of the ANN predictions and targets for testing set No. 5.2 (see Table 2 in the article).

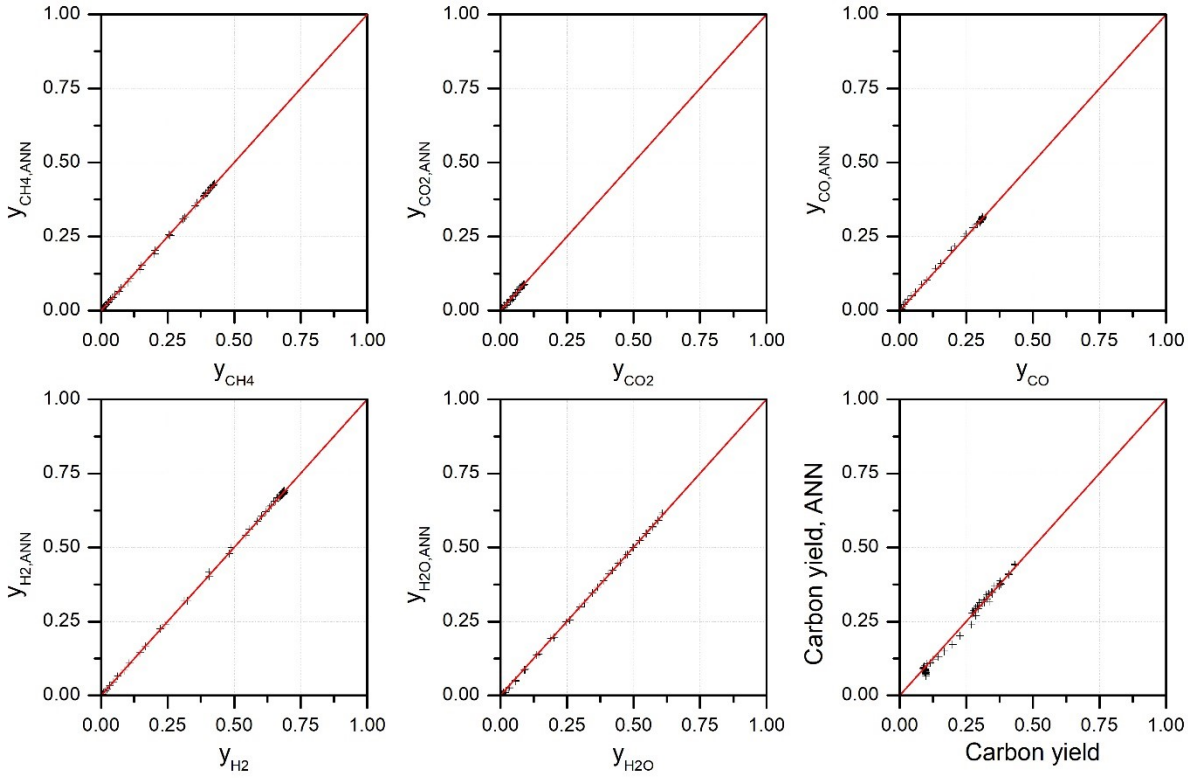

Fig. 15. Comparison of the ANN predictions and targets for testing set No. 5.3 (see Table 2 in the article).

Tables 1 and 2 present the ANN weights to allow researchers and engineers to directly incorporate the network in their own equilibrium calculations.

Table 1. Trained ANN parameters (synaptic weights) between the input and hidden layers. The ANN architecture consists of 5 input neurons, 40 hidden neurons, 6 output neurons. A weight denoted as $w_{i,1}$ represents the weight between the 1st input neuron and the *i*-th hidden neuron.

Neuron in the hidden layer	Weights					
	wi,1	wi,2	wi,3	wi,4	wi,5	*Bias, bi*
h1	-0.907916594355117	3.27164337681703	-0.646014543821406	-0.391759794370049	0.0113785050484542	*3.23362447078554*
h2	0.233888656335413	-0.802878768033799	-0.255414555342880	1.60904032173777	-0.0638868419900793	*-1.12342315511847*
h3	-1.82176802901100	2.20156124360395	0.460394192771420	1.58803747808628	-0.0558969578482696	*2.14729376321574*
h4	-0.817919696409531	-0.636046129330957	-0.236400772728905	-0.892326731280514	0.0499429632750684	*0.0716033306655599*
h5	-0.00463163004009975	-0.0940992351490791	-0.0551306150626950	3.88063379676678	-0.555468110691581	*1.20483908290581*
h6	0.289620144929912	-1.90293718883560	0.366572254703279	-1.93671788410678	0.0800830104155484	*-2.77383319079088*
h7	-0.996903547683568	1.40652600753122	-0.325727857110446	1.04092998917673	-0.0488533181124923	*1.31102211588350*
h8	1.47362416386804	-0.736280095152739	-0.627712596222488	-2.33703114890844	0.170004455949834	*-0.447315042195127*
h9	-0.357819710360007	-1.31850720210538	1.44955111693982	6.38062879142763	-0.275699414177476	*-0.627228112694745*
h10	-0.692401340646491	-0.119679585969223	-0.261774737418889	-0.0744039566288533	-0.0247923766302907	*-0.310288224999099*
h11	-0.505537540252708	0.838924398195542	-0.109850649754864	-1.30346513579911	0.0587906060205587	*0.279373789101517*
h12	-1.60219888884069	-0.779036855562251	0.621954236208683	-0.146862533993421	0.0158758688702985	*-2.84020026768637*
h13	-0.786357167608458	-0.549075735714840	0.137803386021561	0.104222601561373	-0.0124934085464774	*-0.489659508921158*
h14	-0.317791965779301	0.187592474521780	0.497834027422262	1.17068161962566	-0.0427603059628430	*1.96906049840988*
h15	-0.624188707389903	0.613823204416107	0.173951580661364	-0.433802291935491	0.0229854849023079	*0.859959635225104*
h16	-0.953064090305814	0.285844690234204	0.302921186970266	0.557147629783008	-0.0258011508868561	*0.610269569702080*
h17	-4.01735533924013	-1.48389108597893	0.757575533338392	-3.02605886501401	0.110412119413734	*-3.70895537496714*
h18	1.30421787960528	-0.791382579371810	-0.719191023420299	-2.26786408241034	0.159452835606870	*-0.590291274402322*
h19	1.48112830812510	0.504355107786945	-0.160366432576766	4.95535956139158	-0.216800982553719	*1.69476410536800*
h20	1.01265487337338	0.0127660647855559	0.261130322846380	1.41266935591108	-0.0255515252718367	*1.56317412206824*
h21	-0.397287704052370	-0.511685207805294	0.364371808794868	4.80559832495778	-0.227651713342158	*0.768777110622065*
h22	0.0294556974682000	-0.0862779469038370	0.0171595467544728	-1.44880456553811	1.86209342792158	*0.973497557186155*
h23	-4.06721781854235	-4.23976346718231	-3.00305380868885	-0.244305321970234	0.0139350814920136	*-7.01184602317433*
h24	-0.103771541186437	-0.290861750868278	-0.417744987738591	1.00940562004899	-0.0361169324774693	*-0.0711775998756274*
h25	-1.77646472775514	-0.456296158451212	-0.976385568038365	1.62970047202742	-0.0703176795048643	*-1.98691600551182*
h26	0.0667880517885743	-0.0553678361846921	-0.0297090002148904	3.73251063368874	-0.452398211217646	*1.12862269910376*

h27	-1.20594963691550	0.570188502090267	-0.331849879781812	-3.81257156617932	0.164517782083781	*-2.14744577621522*
h28	2.29988879191104	-0.813138142403438	-1.16115449757146	-1.18543024995594	0.0539754088814550	*1.27764794667838*
h29	0.315321436654600	0.0853784328292868	-1.31003638889946	1.66865315265125	-0.0629888754480656	*0.596212269029805*
h30	-2.89801908877911	-0.0720146716612561	0.0172426143492057	0.593006773261278	0.455006530726976	*-3.28792715113439*
h31	-1.79259305692103	4.31796397875724	1.13468310536273	0.118954304662573	-0.0117865571370451	*-0.797358810271147*
h32	1.60840144776773	0.985831251742901	0.611463420582907	-0.0151715522507497	0.00505746615433162	*4.00959219229460*
h33	0.350803374133757	-0.403695071118726	-0.401333734597938	1.32383180338598	-0.0391352436416737	*0.696649869247508*
h34	0.934791307993708	0.853216214029097	0.980887325225082	1.05409009610170	-0.0535921540869912	*2.00561679370393*
h35	0.353360821927622	0.626714255118179	0.340413206872353	5.89349502921492	-0.300146477570000	*1.07802869721107*
h36	-3.09119223650703	-0.162238054538317	-0.0105326051843008	0.525677157864143	0.295132915894483	*-3.48058627313065*
h37	-0.0210159330752938	0.737071131121065	0.269097428413047	1.77540967886457	-0.0575216926933721	*3.03062865217252*
h38	0.996197256341004	-0.0194161049786822	0.0844974306213449	2.97224278065418	-0.149164921051050	*2.12428554498078*
h39	1.17537221519438	1.37832821498877	-1.22840324965565	1.67874693849263	-0.0692250599288325	*2.77237921166054*
h40	-3.96381720750098	0.558163786583869	-2.88984494477955	-0.130837915718820	0.00913108240948485	*-2.06872909982273*

Table 2. Trained ANN parameters (synaptic weights) between the hidden and output layers. The ANN architecture consists of 5 input neurons, 40 hidden neurons, 6 output neurons. A weight denoted as $w_{i,1}$ represents the weight between the 1st output neuron and the *i*-th hidden neuron.

Neuron in the hidden layer	Weights					
	wi,1	wi,2	wi,3	wi,4	wi,5	wi,6
Bias, bi	*0.989007137*	*-0.06244379*	*-2.972516784*	*0.232380994*	*-1.635372374*	*3.141808185*
h1	0.155034785	0.274133277	0.21708887	-0.027264349	-0.398818654	0.935454044
h2	0.309623922	1.569535303	-2.129619592	-0.111814864	0.293892638	1.502795153
h3	-1.451116929	-0.941199236	-0.503777369	0.646121119	1.646835588	1.874310605
h4	-0.443259295	-0.532519203	-0.018051105	0.188279852	0.557450937	1.531029851
h5	0.951307593	-0.485983715	0.074821591	-1.361114394	0.644135419	-0.958403903
h6	-1.664761596	-0.989479271	0.303215953	0.752267024	1.304388835	0.67692872
h7	0.755981179	0.218230377	0.881883103	-0.518817659	-0.895359227	-2.400877562
h8	0.699226743	0.041902036	-0.970145938	-0.473145285	0.316986185	2.549848574
h9	-0.003401601	0.094862238	-0.129185785	-0.008082449	0.044333533	0.143308161
h10	0.124435276	-1.27907097	-1.434487476	-1.235383138	2.717504173	2.635559135
h11	0.520152415	1.811903832	-2.032440725	-0.147539486	-0.075296537	0.853363977
h12	-0.143083245	-0.801778102	-0.047372229	-1.113959095	1.833771891	3.395171943
h13	1.003431576	1.747860567	0.678326875	0.512233868	-2.949693158	-4.718615098
h14	-2.064806937	-1.299888887	0.066481203	0.97110158	1.766242099	-2.863782219
h15	0.312573197	0.339342602	0.885818767	0.609430284	-1.733982695	-5.316739351

h16	-1.494762553	-0.803803828	-1.143118967	1.075286086	1.530432593	3.929082694
h17	-0.002643703	0.023791042	-0.116699266	-0.003800614	0.065925984	0.15702557
h18	-0.507971453	-0.183419336	1.175146508	0.392821969	-0.494904731	-3.142970041
h19	-0.001224123	0.354351019	-0.430753308	0.005004064	0.081405025	0.343798291
h20	0.979240217	1.084740542	-0.054910215	-0.401163096	-1.134479829	-2.266137497
h21	-0.001583243	-0.387316737	0.461903217	0.074831161	-0.169669136	-0.131330886
h22	0.020122915	-0.000315837	-0.030851937	-0.036927392	0.037241086	0.028648088
h23	0.009115725	0.168892885	-0.827462223	-0.048760968	0.453276264	1.753671304
h24	-1.438798497	-3.938421834	3.164768262	0.495728072	1.08173711	2.163234879
h25	1.842638017	0.86864023	0.680362336	-0.86273534	-1.908194995	-2.318408892
h26	-1.306166581	0.726324963	-0.221587061	1.892225679	-0.868304995	1.336267155
h27	0.154647443	-0.223220316	0.562628367	0.100771584	-0.510533642	-0.631485354
h28	0.274607566	0.138998217	0.558348592	-0.006227636	-0.703665909	-2.222433882
h29	1.094748599	0.563992917	-0.430933913	-0.678408869	-0.465509701	1.125414807
h30	-0.327475355	-0.109260633	-0.173327792	0.176456419	0.324141093	1.034981347
h31	0.002308604	0.17184041	-0.813946612	-0.038681184	0.440065463	1.680605355
h32	-0.40022954	-0.887255551	1.770149748	-2.675544576	2.8398605	2.953487795
h33	-1.502049379	0.372442486	-2.685098583	0.43652752	2.590160274	2.863413967
h34	0.411464885	0.165214357	0.976991119	0.046294501	-1.17988842	-3.73126985
h35	0.002798814	-0.445164594	0.63922157	-0.027918975	-0.138311716	-0.485920404
h36	0.458223455	0.099093337	0.292370717	-0.211239937	-0.496746948	-1.594649027
h37	2.308306362	2.123590811	0.348764239	-0.998999356	-2.664483875	-0.417570091
h38	-0.352237445	0.228236005	-0.003266739	0.561514959	-0.338496755	0.115695714
h39	-2.235941509	-0.936879932	0.163408333	1.238620578	1.444106475	-0.34253826
h40	-0.000873733	-0.172178368	0.875664586	0.023675097	-0.46140225	-1.79640328