Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information

Supplementary Figures:

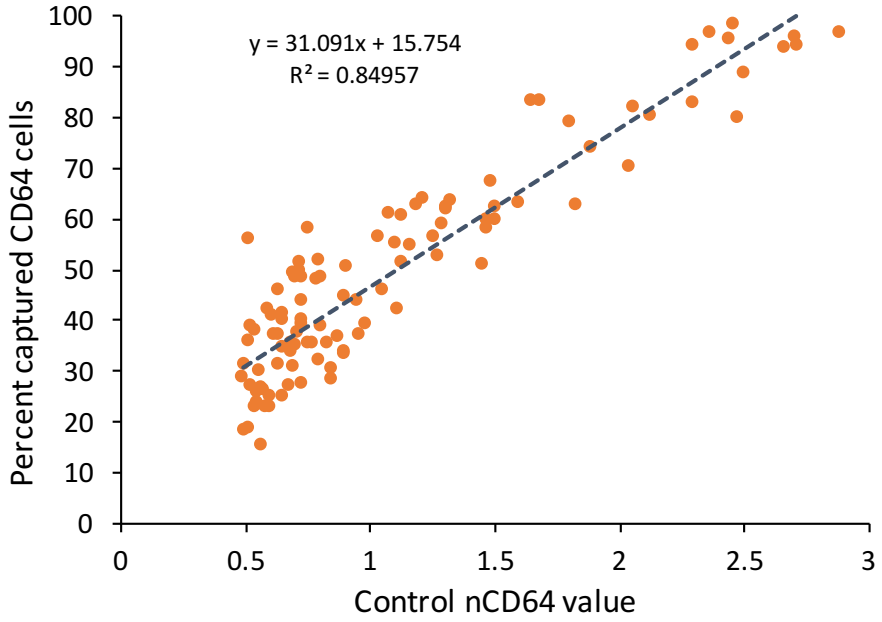

Figure S1: The univariate regression plot showing linear correlation between percent captured granulocyte + monocytes in a capture chamber vs. control nCD64 expression values obtained from flow cytometry.

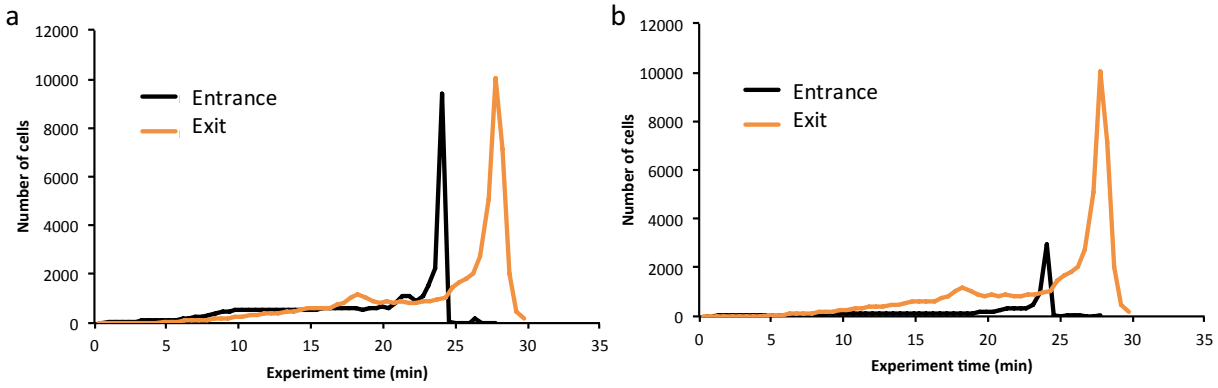

Figure S2: Cell counting with BSA blocked chamber. (a) Number of granulocytes and monocytes counted at entrance and exit electrical counters over time. (b) Number of lymphocytes counted at entrance and exit electrical counters over time.

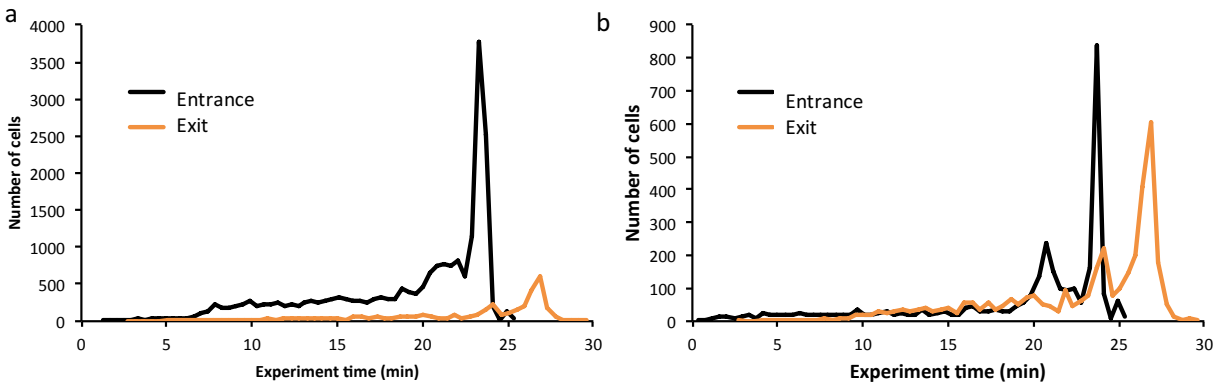

Figure S3: Cell counting with anti-CD64 antibody adsorbed chamber. (a) Number of granulocytes and monocytes counted at entrance and exit electrical counters over time. (b) Number of lymphocytes counted at entrance and exit electrical counters over time.

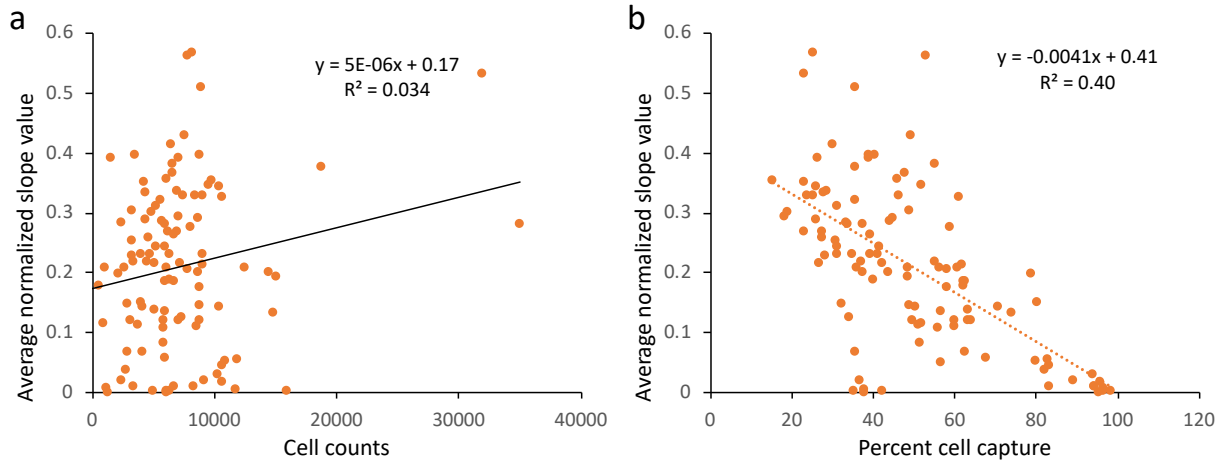

Figure S4: (a) The correlation plot in between slope values and cell counts shows $R^2 = 0.034$. (b) The correlation plot in between slope values and percent cell captured shows $R^2 = 0.40$.

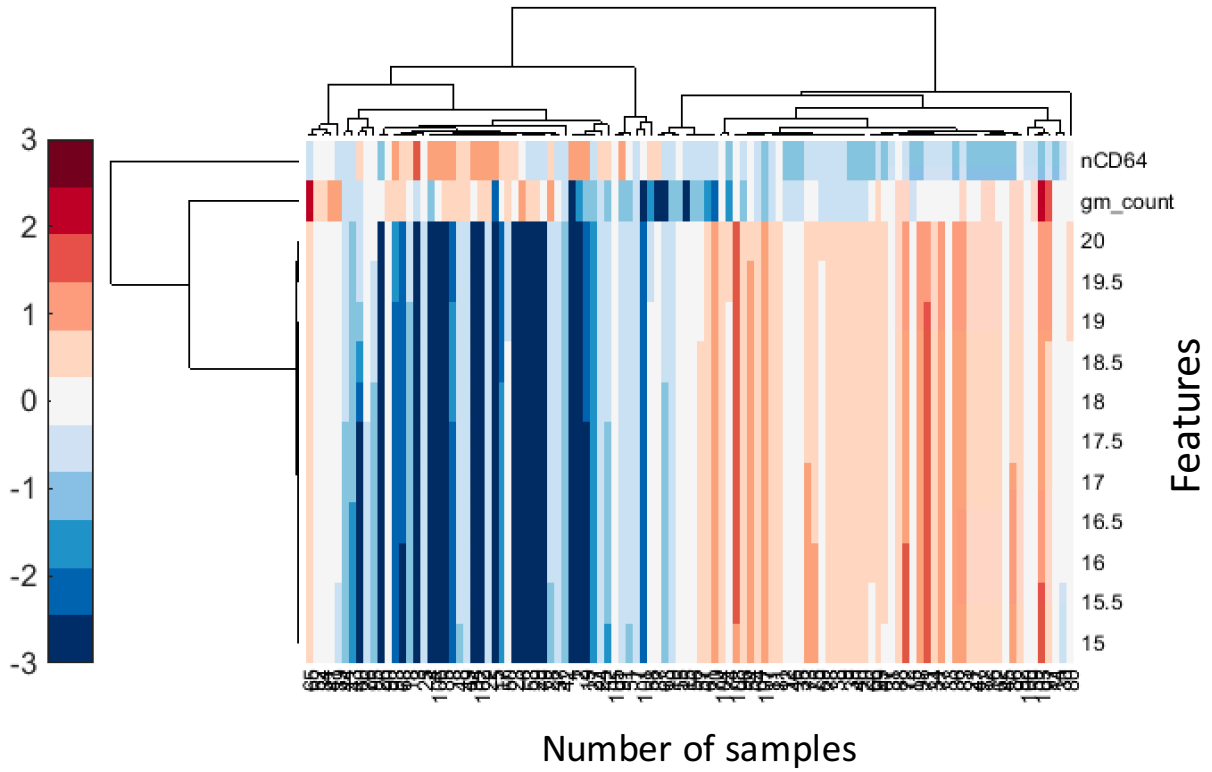

Figure S5: Heat maps showing slope values at different time points are inversely related to nCD64 expression level and granulocyte + monocyte counts. Heat map is obtained using unsupervised 'correlation' clustering method using features for 106 blood sample experiments.

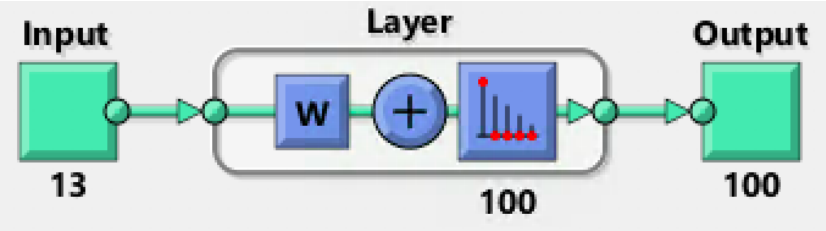

Figure S6: The network diagram of a single layer artificial neural network representing a self-organizing map with 100 neurons. Input to the ANN model was total 13 normalized features (11 slope values, granulocyte + monocyte counts, and nCD64 values). The network was trained using batch SOM algorithm.

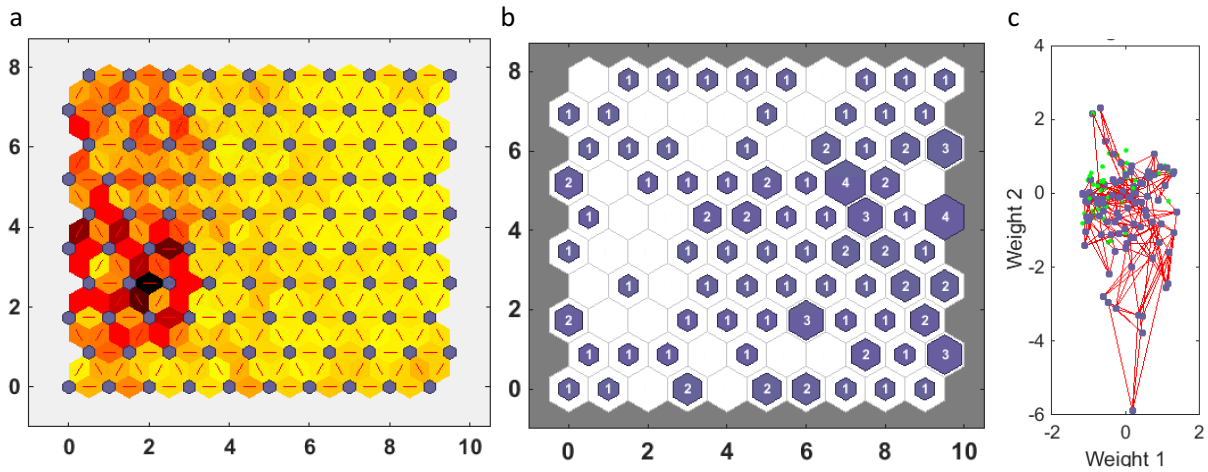

Figure S7: SOM ANN analysis of the 13 features of 106 antibody chamber experiments (a) SOM neighbor weight distances. It shows neurons as gray-blue patches. The neighbor relation is shown with red lines. The neighbor hexagons are colored from black – yellow, which represents the closeness of each neuron's weight vector to its corresponding neighbors. (b) SOM layer showing sample hits. Each neuron represented by a hexagon shows numbers which represents number of inputs it classifies. Colored patch size represents number of vectors for each neuron. (c) SOM weight positions. The input space is classified by dots representing neurons weight vectors and corresponding neighboring neurons are connected with red lines.

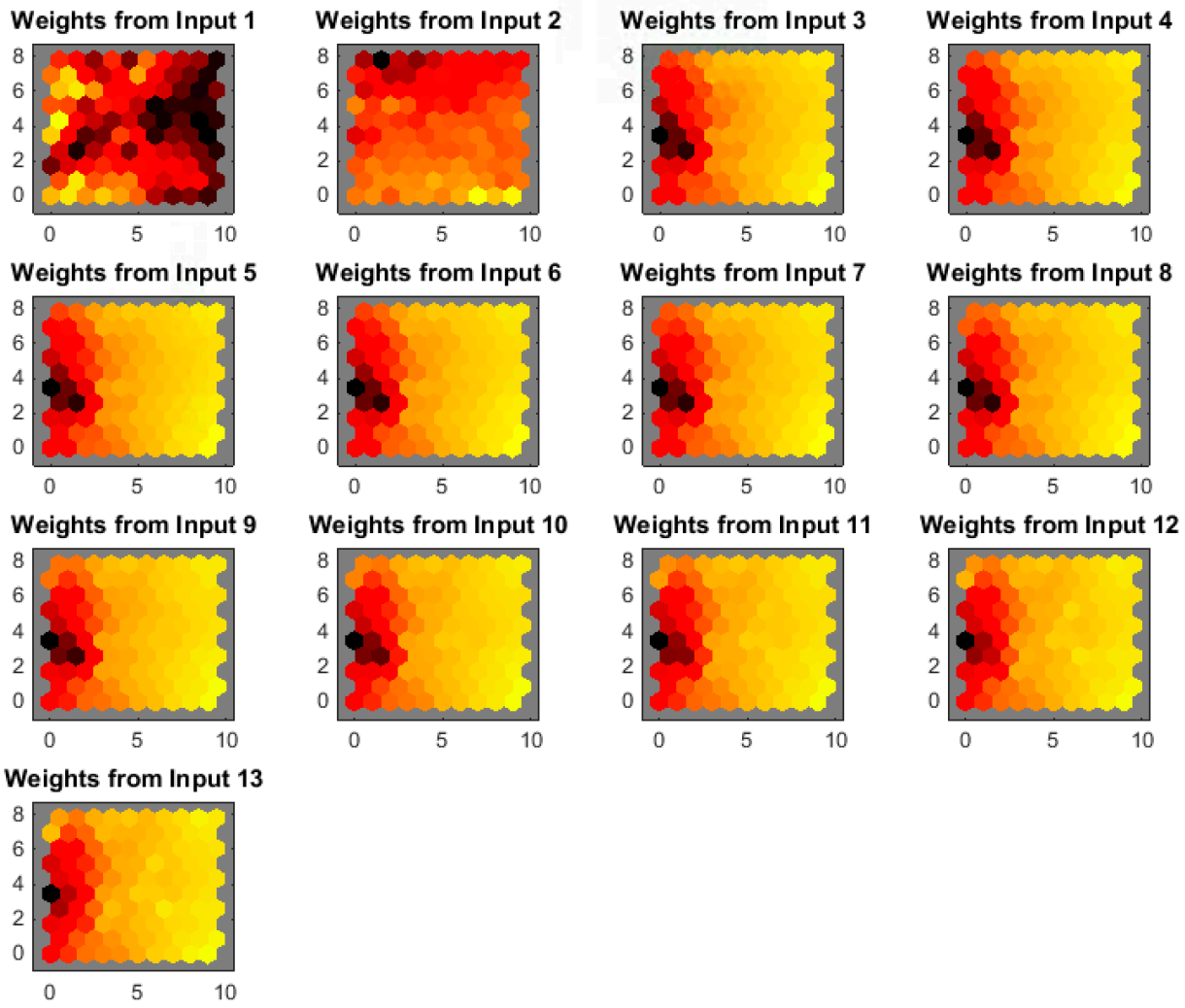

Figure S8: SOM input weight planes. Each plot represents the specific input to the layers neuron. Input 1 is nCD64 values, input 2 is cell counts and rest of the inputs are slope values. Zero connections are represented as black, and strong positive connections are represented as red. Input 1 is nCD64 values with low black connections showing its dependency to the slope values.

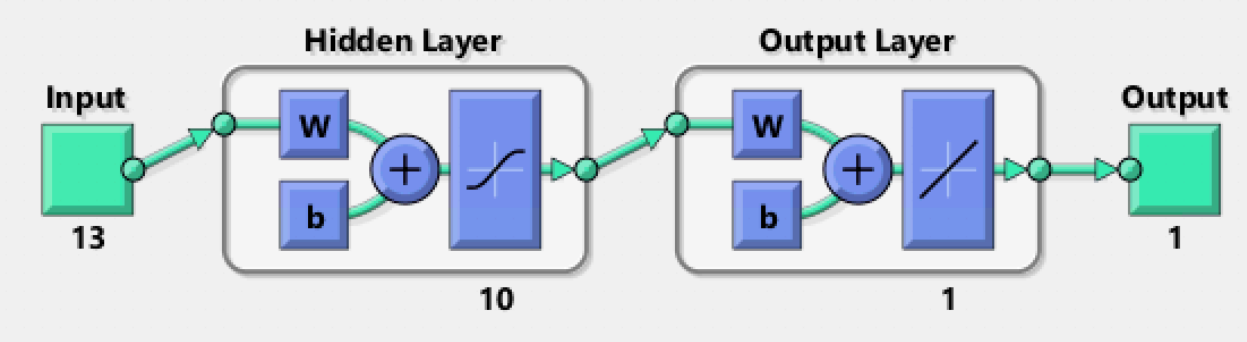

Figure S9: The network diagram of a two-layer feed-forward artificial neural network with sigmoid hidden and softmax output neurons. It consists of 10 neurons in hidden and 1 neuron in output layers respectively. Input to the ANN model was total 13 normalized features (11 slope values, granulocyte + monocyte counts, and nCD64 values). The network was trained using different trainings method.

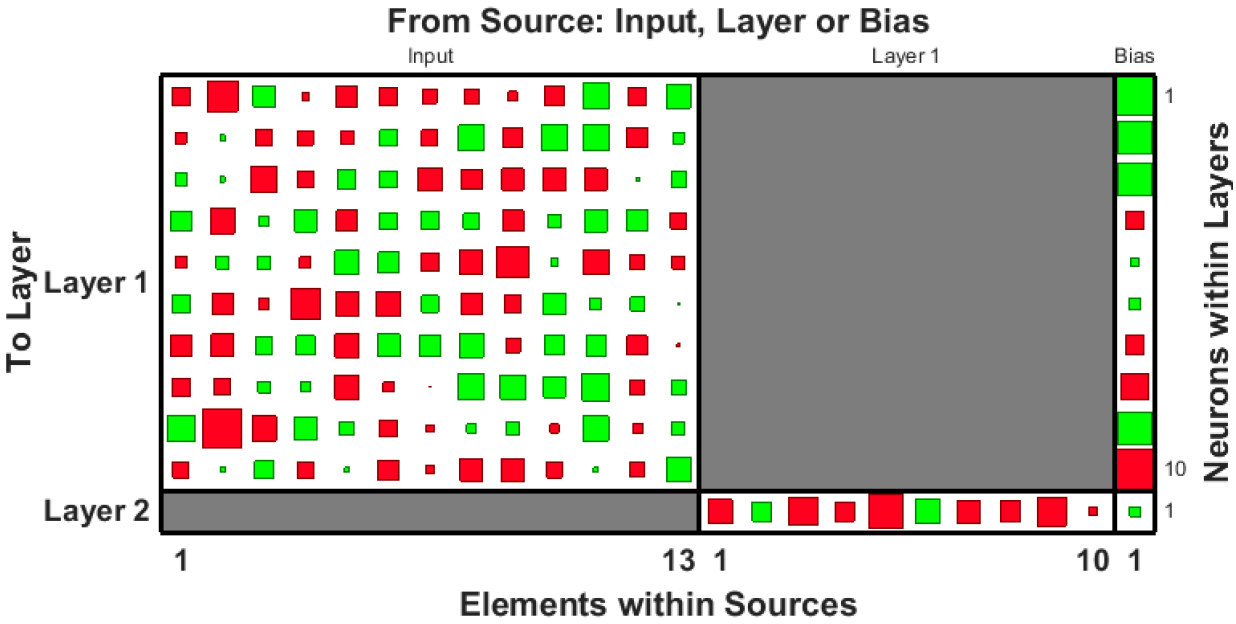

Figure S10: Hinton diagram representing the weight and bias value of the input (hidden) and output layers of neurons used in our artificial neural network model trained using Lavenberg Marquardt method.

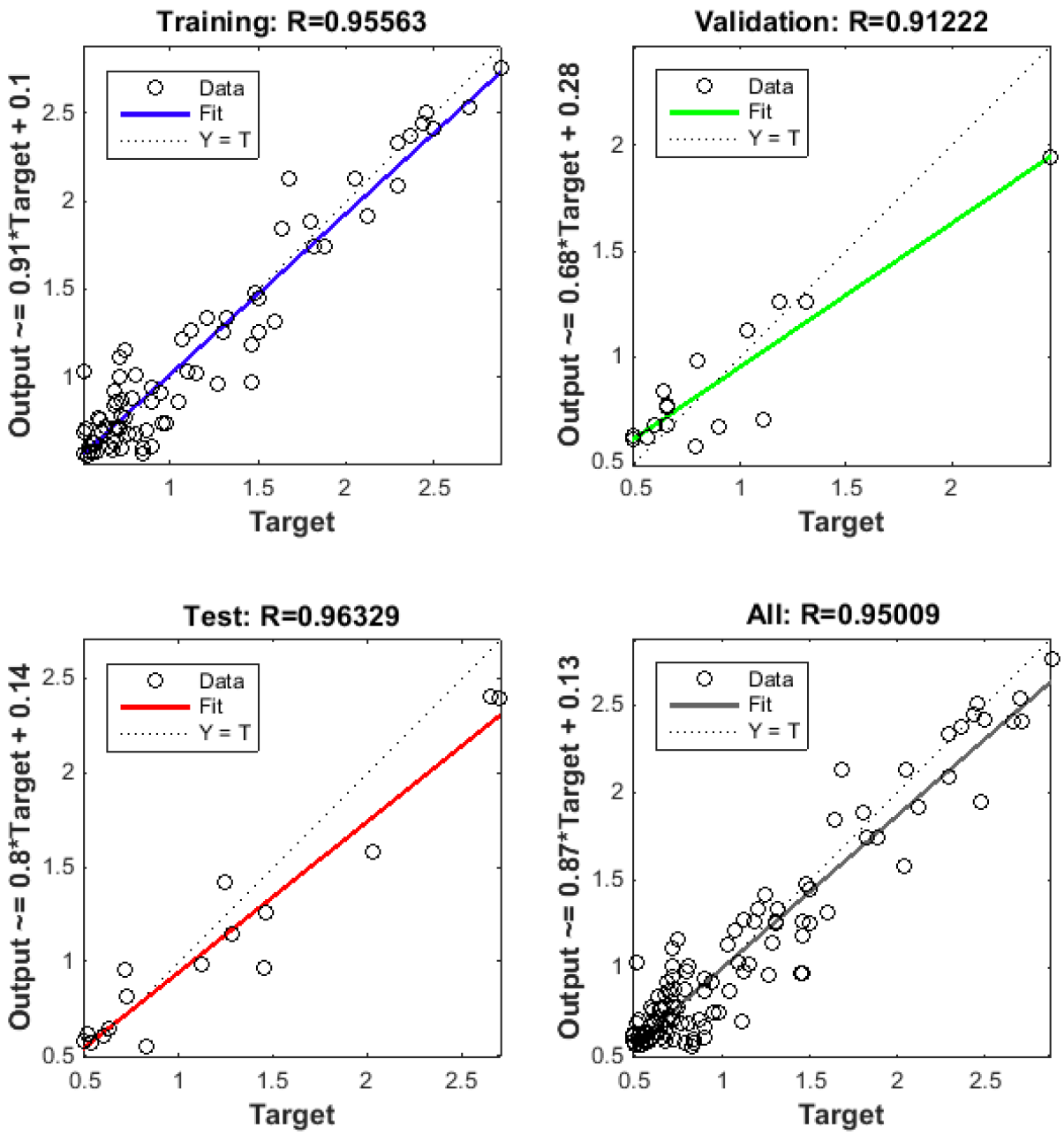

Figure S11: The input features data (nCD64, Granulocyte + monocyte counts, and slopes values at different times) are inputted to the ANN model shown in Figure S8 and the model is trained using Lavenberg Marquardt training algorithm. The regression plots are shown for training, validation, testing and the entire data set combined.

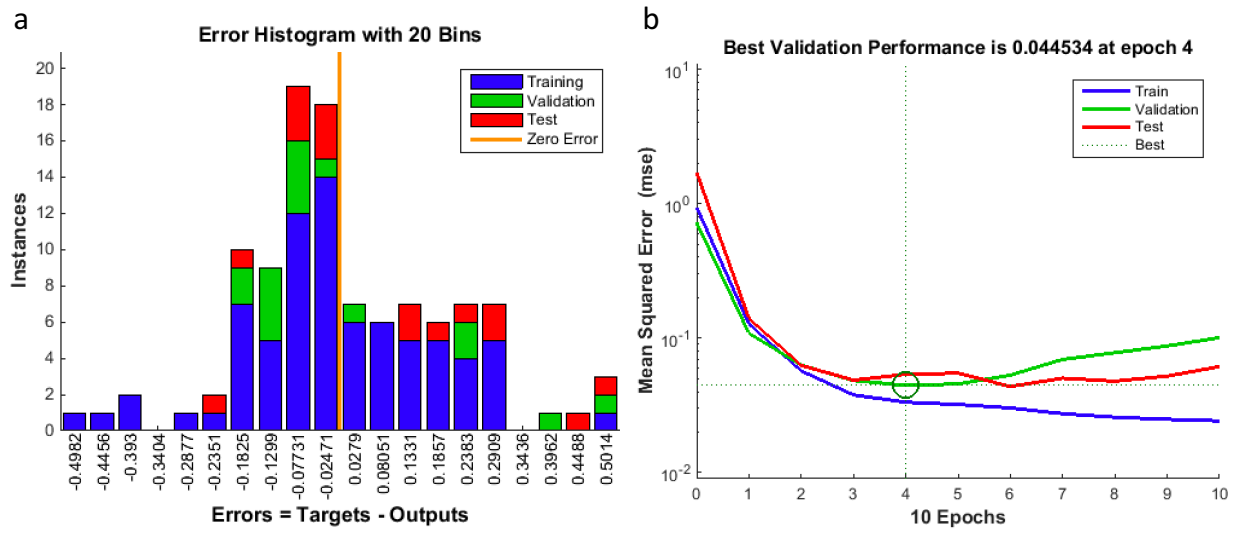

Figure S12: Artificial neural network performance trained with Lavenberg Marquardt method showing, (a) error histogram, and (b) mean squared error at different epochs in time.

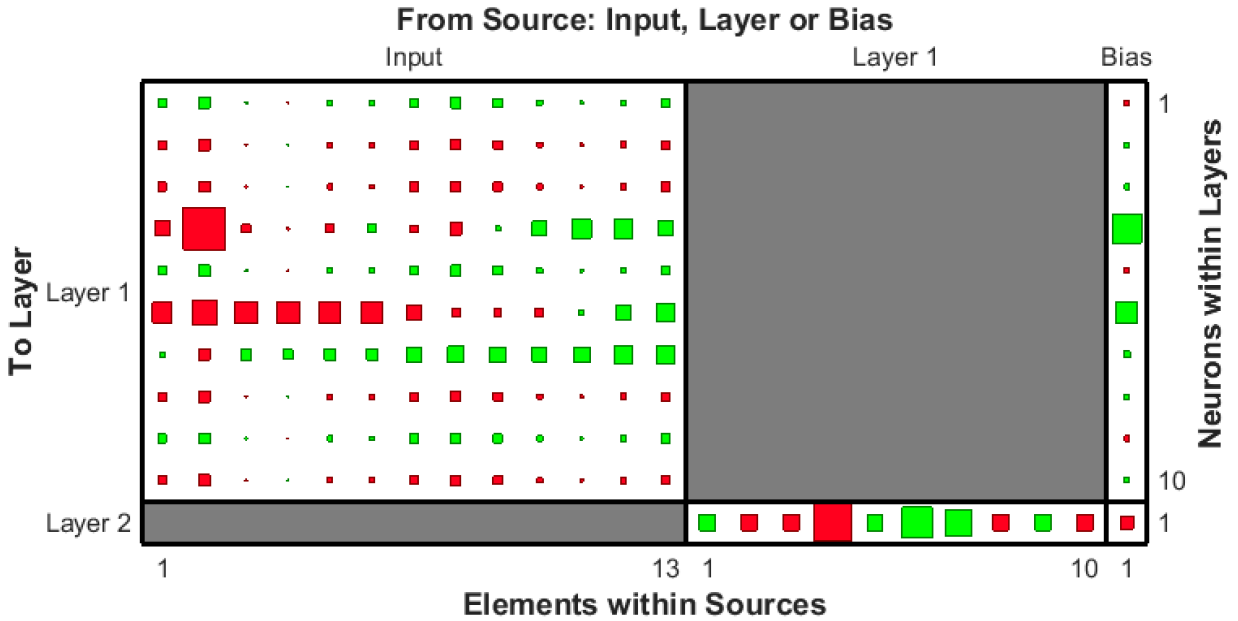

Figure S13: Hinton diagram representing the weight and bias value of the input (hidden) and output layers of neurons used in our artificial neural network model trained using Bayesian Regularization method.

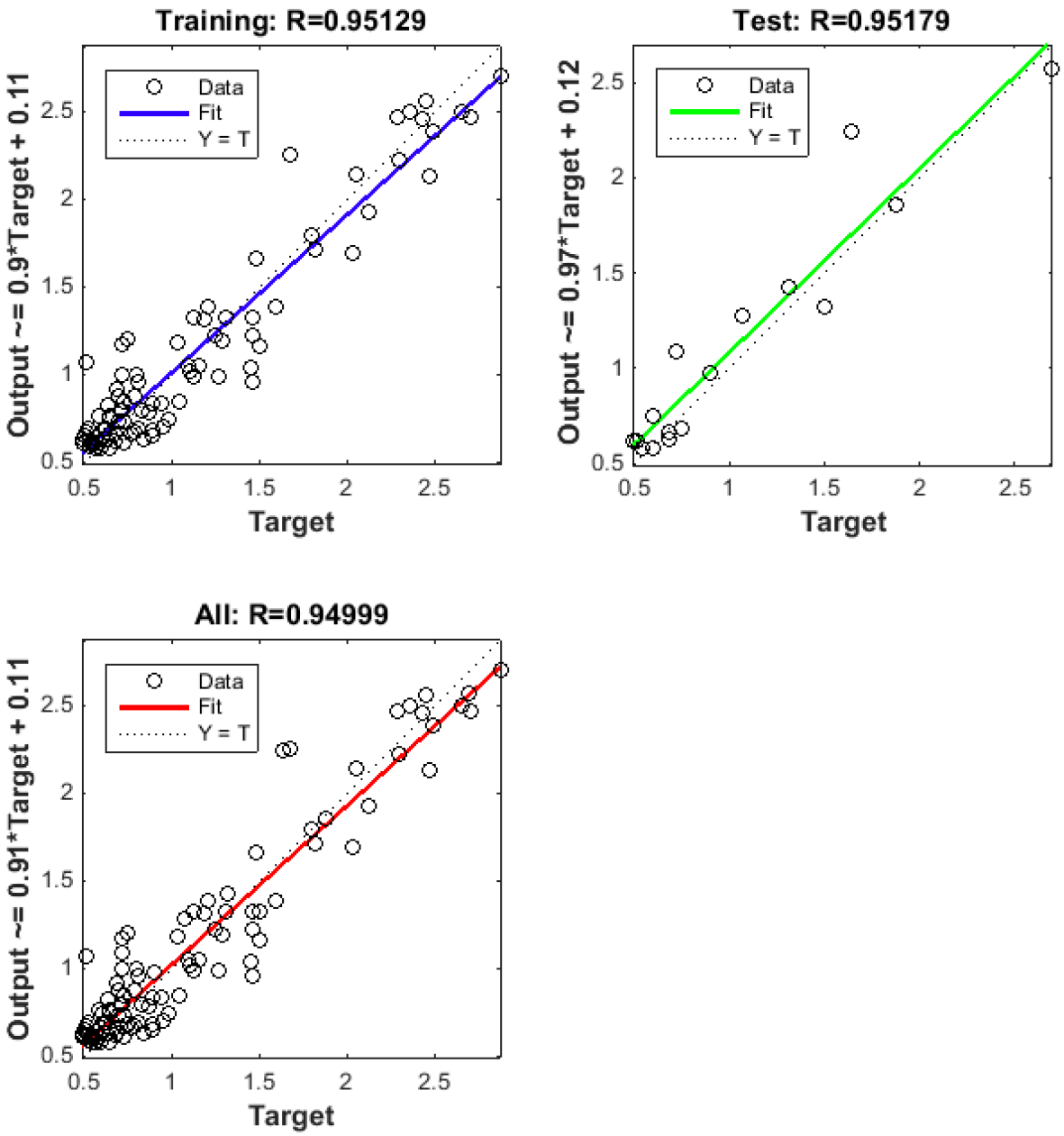

Figure S14: The input features data (nCD64, Granulocyte + monocyte counts, and slopes values at different times) are inputted to the ANN model shown in Figure S8 and the model is trained using Bayesian Regularization training algorithm. The regression plots are shown for training, testing and the entire data set combined.

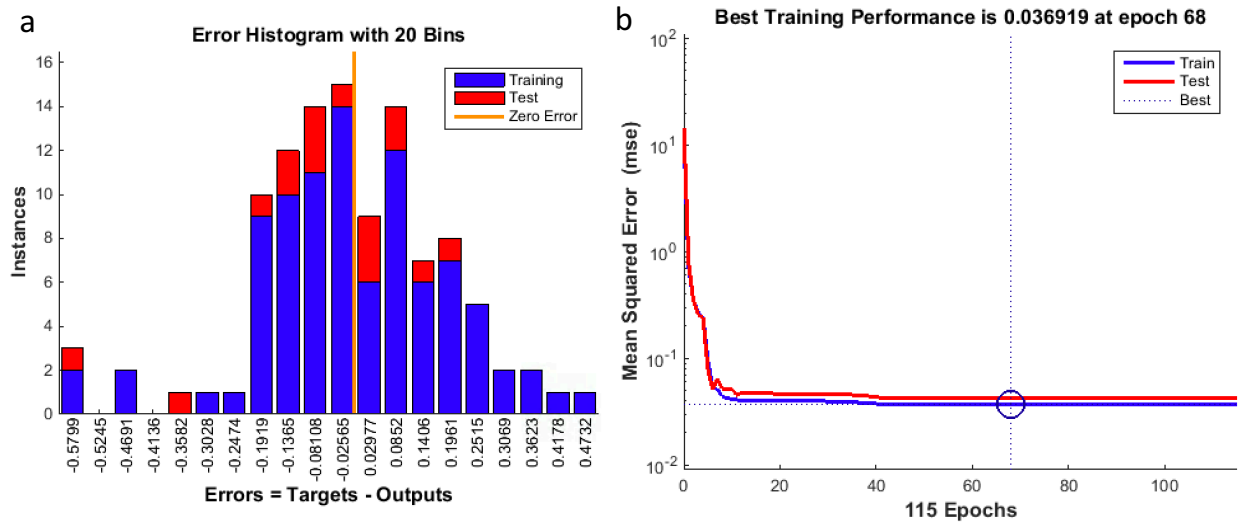

Figure S15: Artificial neural network performance trained with Bayesian Regularization method showing, (a) error histogram, and (b) mean squared error at different epochs in time.

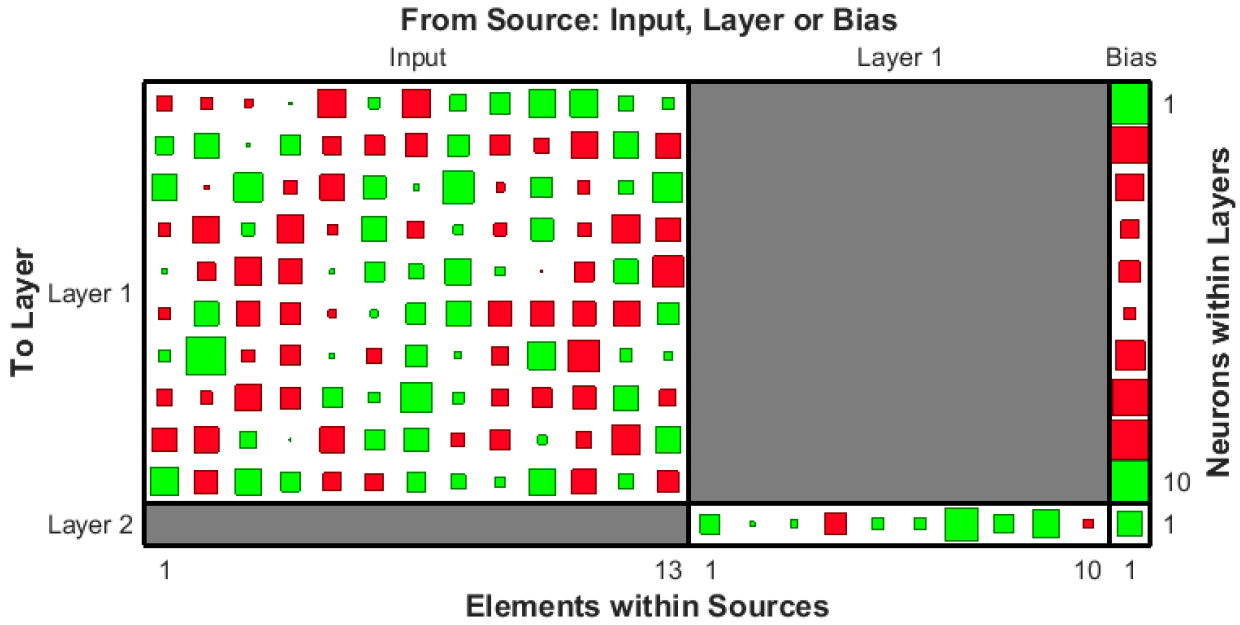

Figure S16: Hinton diagram representing the weight and bias value of the input (hidden) and output layers of neurons used in our artificial neural network model trained using Scaled Conjugate backpropagation method.

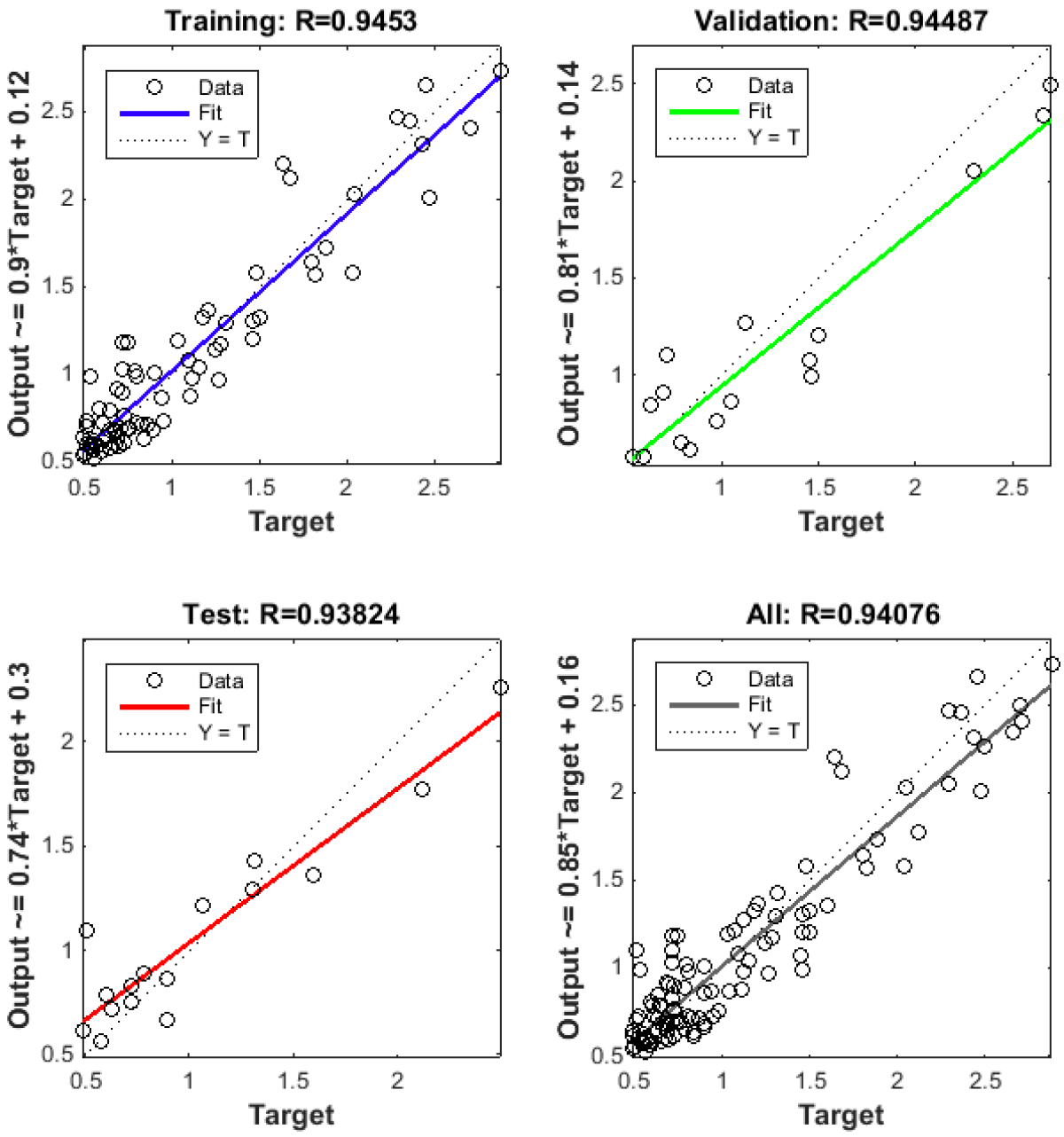

Figure S17: The input features data (nCD64, Granulocyte + monocyte counts, and slopes values at different times) are inputted to the ANN model shown in Figure S8 and the model is trained using Scaled Conjugate backpropagation training algorithm. The regression plots are shown for training, testing and the entire data set combined.

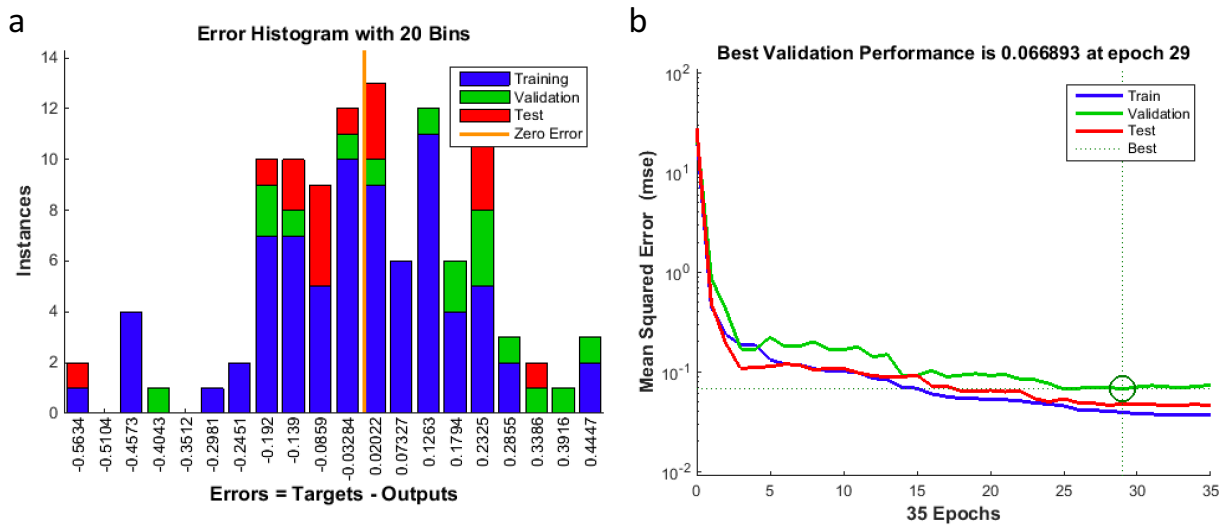

Figure S18: Artificial neural network performance trained with Scaled Conjugate method showing, (a) error histogram, and (b) mean squared error at different epochs in time.

Supplementary Tables:

Input Layer

Output Layer

Neurons Weight Values

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Bias	O
W1	-0.415	-1.108	0.544	-0.060	-0.527	-0.395	-0.234	-0.250	-0.103	-0.448	0.829	-0.408	0.672	1.768	-0.689
W2	-0.143	0.035	-0.314	-0.271	-0.225	0.323	-0.307	0.788	-0.452	0.819	0.813	-0.489	0.147	1.315	0.439
W3	0.183	0.032	-0.780	-0.310	0.395	0.364	-0.660	-0.491	-0.541	-0.588	-0.586	0.012	0.280	1.280	-0.959
W4	0.476	-0.738	0.126	0.566	-0.523	0.336	0.376	0.285	-0.521	0.230	0.595	0.533	-0.307	-0.378	-0.454
W5	-0.178	0.186	0.213	-0.152	0.663	0.496	-0.368	-0.651	-1.168	0.073	-0.749	-0.271	-0.204	0.074	-1.366
W6	0.381	-0.535	-0.124	-1.021	-0.651	-0.686	0.323	-0.556	-0.320	0.547	0.146	0.222	0.003	0.135	0.717
W7	-0.529	-0.608	0.341	0.426	-0.662	0.617	0.521	0.679	-0.250	0.466	0.486	-0.464	-0.013	-0.428	-0.622
W8	-0.392	-0.342	0.164	0.124	-0.706	-0.119	-0.001	0.806	0.730	0.542	0.892	-0.260	0.263	-0.849	-0.485
W9	0.829	-1.867	-0.701	0.661	0.245	-0.372	-0.056	0.097	0.203	-0.089	0.766	-0.112	0.198	1.271	-0.989
W10	-0.309	0.030	0.400	-0.334	0.029	-0.472	-0.088	-0.582	-0.603	-0.282	0.029	-0.254	0.699	-2.078	-0.089

Bias value of the output neuron = 0.1223

Table S1: The weight and bias values of all the neurons in input and output layers (ANN trained with Lavenberg Marquardt method)

Input Layer

Output Layer

Neurons Weight Values

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Bias	O
W1	0.060	0.107	0.003	-0.002	0.023	0.020	0.063	0.095	0.066	0.024	0.007	0.028	0.063	-0.022	0.221
W2	-0.060	-0.106	-0.003	0.002	-0.023	-0.020	-0.063	-0.094	-0.065	-0.024	-0.007	-0.028	-0.062	0.022	-0.220
W3	-0.060	-0.106	-0.004	0.002	-0.023	-0.020	-0.063	-0.094	-0.065	-0.024	-0.007	-0.028	-0.062	0.022	-0.220
W4	-0.200	-1.570	-0.064	-0.004	-0.064	0.057	-0.048	-0.128	0.019	0.191	0.312	0.311	0.187	0.766	-1.286
W5	0.060	0.107	0.003	-0.002	0.023	0.020	0.063	0.095	0.066	0.024	0.007	0.028	0.063	-0.022	0.221
W6	-0.342	-0.545	-0.422	-0.452	-0.399	-0.383	-0.203	-0.060	-0.053	-0.062	0.021	0.181	0.321	0.378	0.807
W7	0.019	-0.108	0.107	0.080	0.106	0.105	0.182	0.234	0.214	0.187	0.218	0.274	0.320	0.040	0.623
W8	-0.060	-0.107	-0.003	0.002	-0.023	-0.020	-0.063	-0.094	-0.065	-0.024	-0.007	-0.028	-0.063	0.022	-0.220
W9	0.060	0.107	0.003	-0.002	0.023	0.020	0.063	0.094	0.065	0.024	0.007	0.028	0.063	-0.022	0.220
W10	-0.060	-0.107	-0.003	0.002	-0.023	-0.020	-0.063	-0.094	-0.065	-0.024	-0.007	-0.028	-0.063	0.022	-0.220

Bias value of the output neuron = -0.1492

Table S2: The weight and bias values of all the neurons in input and output layers (ANN trained with Bayesian Regularization method)

Input Layer

Output Layer

Neurons Weight Values

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	Bias	O
W1	-0.236	-0.140	-0.064	0.005	-0.771	0.109	-0.794	0.251	0.406	0.708	0.706	0.233	0.127	1.728	0.371
W2	0.296	0.606	0.008	0.383	-0.312	-0.367	-0.494	0.437	-0.401	-0.207	-0.694	0.628	-0.599	-1.322	0.021
W3	0.600	-0.018	0.768	-0.180	-0.599	0.497	0.033	0.936	-0.067	0.434	-0.141	0.192	0.837	-0.694	0.059
W4	-0.157	-0.663	0.145	-0.723	-0.106	0.602	-0.263	0.080	-0.139	0.463	-0.163	-0.748	-0.534	-0.302	-0.465
W5	0.033	-0.304	-0.731	-0.566	0.021	0.372	0.194	0.659	0.081	-0.003	-0.371	0.538	-0.887	-0.402	0.125
W6	-0.136	0.546	-0.531	-0.420	-0.057	0.050	0.378	0.596	-0.535	-0.518	-0.511	-0.659	0.466	-0.144	0.118
W7	0.147	1.435	-0.150	-0.384	0.026	-0.228	0.449	0.048	-0.284	0.739	-0.936	0.156	0.076	-0.842	1.064
W8	-0.231	-0.139	-0.631	-0.426	0.373	0.109	0.893	0.122	-0.254	-0.357	-0.494	0.580	-0.263	-1.256	0.343
W9	-0.519	-0.586	0.269	0.003	-0.597	0.373	0.580	-0.169	-0.374	0.075	-0.222	-0.794	0.607	-1.536	0.714
W10	0.767	-0.530	0.630	0.347	-0.314	-0.287	0.339	0.209	0.097	0.713	-0.584	0.224	-0.426	1.668	-0.080

Bias value of the output neuron = 0.5628

Table S3: The weight and bias values of all the neurons in input and output layers (ANN trained with Scaled Conjugate Gradient method).