Artificial intelligence vs. statistical modeling for optimization of recombinant antibody fragment production

Majid Basafa[1], atieh hashemi[1], and Aidin Behravan[1]

[1]Shahid Beheshti University of Medical Sciences

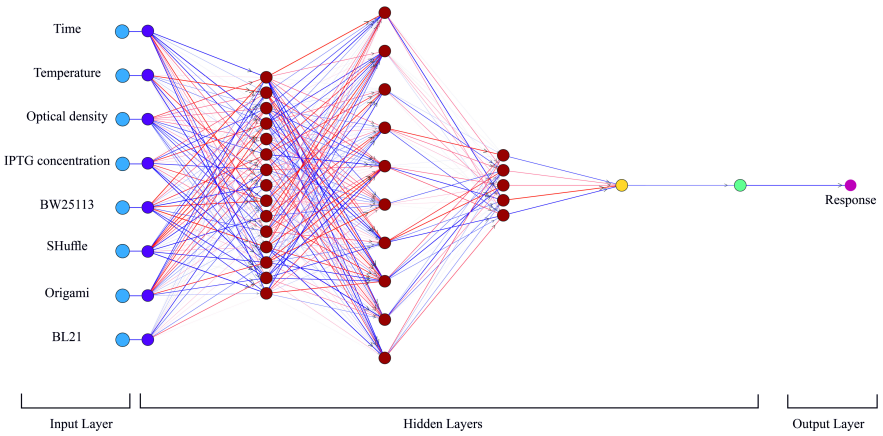
November 21, 2023

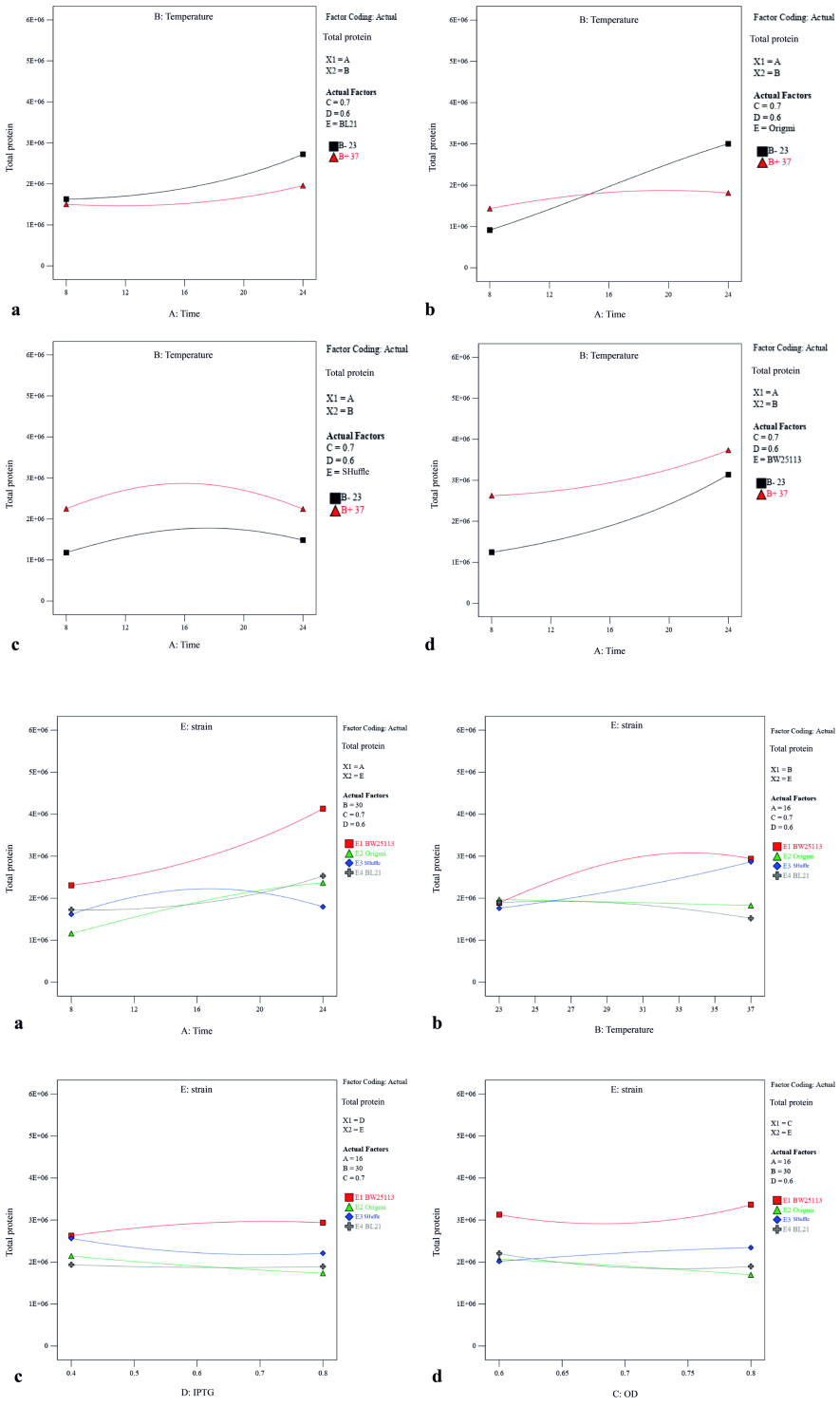
Abstract

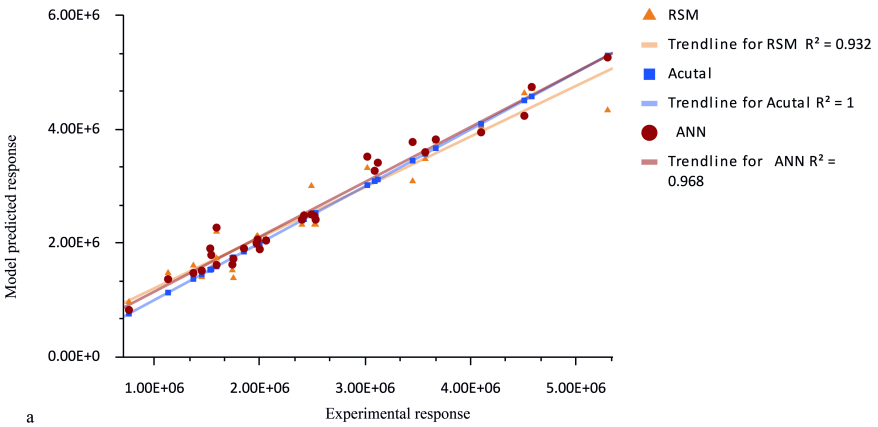
Maximizing the recombinant protein yield necessitates optimizing the production medium. This can be done using a variety of methods, including the conventional "one-factor-at-a-time" approach and more recent statistical and mathematical methods like the artificial neural network ANN (artificial neural network), GA (genetic algorithm), etc. Every approach has advantages and disadvantages of its own, yet even when a technique has flaws, it is nevertheless used to get the best results. Here, one categorical variable and four numerical parameters including post-induction time, inducer concentration, post-induction temperature, and cell density of induction time were optimized using the 232 experimental assays of the CCD (central composite design). The direct and indirect effects of factors on the yield of anti-EpEx (anti-EpCAM extracellular domain) fragment antibody were examined using statistical methods. Induction at the cell density of 0.7 and an IPTG (Isopropyl β-D-1-thiogalactopyranoside) concentration of 0.6 mM for 32 hours at 30 °C in BW25113 was the ideal culture condition leading to the protein yield of 259.51 mg/L. Under the optimum condition, the output values predicted by the ANN model (259.83 mg/L) was more in line with the experimental data (259.51 mg/L) than the RSM (response surface methodology) (276.13 mg/L) expected value. This outcome demonstrated that the ANN model outperforms the RSM in terms of prediction accuracy.

Hosted file

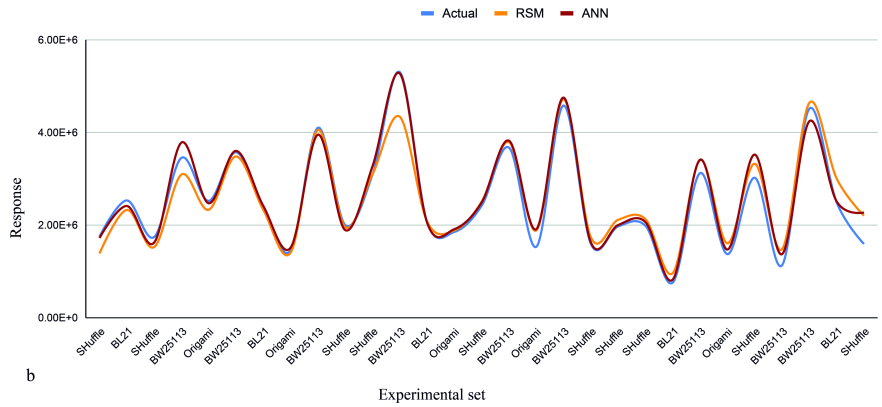
`manuscript.1.doc` available at https://authorea.com/users/702383/articles/688342-artificial-intelligence-vs-statistical-modeling-for-optimization-of-recombinant-antibody-fragment-production







a



b

Hosted file

Table 1.doc available at https://authorea.com/users/702383/articles/688342-artificial-intelligence-vs-statistical-modeling-for-optimization-of-recombinant-antibody-fragment-production