

A Study on Essence of Artificial Intelligence to Develop Some Bio-Models for Sustainability and Green Technology

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ABSTRACT

The present paper deals with the essence of artificial intelligence to develop some models for sustainability and green technology. An attempt has been made to develop some Bio models to enhance accuracy, efficiency and predictive power in bio-research and health care. In the present paper we have restricted ourselves to data driven modeling, simulation and prediction, personalized medicine, automation and optimization, ethical and sustainable research. The role of Artificial Intelligence in developing Bio-models lies its ability to transform biological data into intelligent predictive and adaptive systems that deepen our understanding of life process and improve health care outcomes.

Keywords- V Sustainability, Green Technology, Simulation, Adaptive system.

I. INTRODUCTION

Mathematical modeling in all areas and all types of industries in Bio-mathematics and pollution control are going to be in progress. Another way to encourage mathematical modeling activities is through modeling contests like those which have been organized very successfully for the last years. Mathematized modeling clinics for undertaking projects for small scale industries, Green Sustainability, a practice of using natural resources responsibly and efficiently to meet present needs without compromising the ability of future. The essence of Green Sustainability seems clearly is environmental protection, efficient resources use, change of climate and migration, economic and social balance, innovation and Technology. Artificial Intelligence plays a pioneer role in promoting green sustainability.

II. SURVEY OF LITERATURE

Most researchers have already worked on the similar topics. By studying their outcomes we have been motivated to work on such topic. Patel et al (2023) did

excellent work on Artificial Intelligence and its application, in their study they clearly explored the various areas where artificial Intelligence plays a vital role. Zinner et al (2023) worked on the role of green technology, they clearly explained optimization and air quality matters. Kumar et al (2023) did work on mathematical modelling of fingers-imbibition under gravitational and magnetization to find out the results. They have used VIM and MATLAB. Wafai et al (2025) did a remarkable work on source code generation based on deep learning. They clearly explained the models on recurrent neural networks. Bahad, A, and Sokhansanj (2025) did and excellent work on Local AI governance.

It was observed that AI plays a vital role in development of some real world problems most of Bio-Models usually involves hundreds of decisions variables and constraints. Likewise most of the business problems such as blindsiding problems of oil refineries may involve thousands of variables and constraints. No doubt the Artificial Intelligence is an essential and integral part of developing the Bio-Mathematical Models. In present age Bio-Mathematical modelling and artificial intelligence are growing parallel. It appears that in coming years the

line dividing the two methodologies will disappear and the few sciences will combine to form a more general and comprehensive science.

Food Type	(Yield /unit) Protein	(Yield /unit) Fats	(Yield /unit) Carbohydrates	Cost /unit
1	d	e	a	α
2	b	f	b	β
3	c	g	g	γ
4	d	h	h	δ
Minimum requirement	A	B	C	

III. MATHEMATICAL MODEL FOR DIET PROBLEM

If x_1, x_2, x_3 and x_4 denotes the food type 1, 2, 3, 4, and our objective is to minimize the cost and best output.

Minimize $Z = (\alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4)$ constraints are on the fulfilment of daily requirements

For Proteins : $\alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 \geq A$

For Fats : $\alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 \geq B$

For Carbohydrate : $\alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 \geq C$

This problem will easily solved for desired results.

IV. POLLUTION TRANSPORT MODEL

This will be governed by the following equations:

$$A(h) = \frac{\partial}{\partial x} [T_{xx} \frac{\partial h}{\partial x}] + \frac{\partial}{\partial y} [T_{yy} \frac{\partial h}{\partial y}] + R - Q = s \frac{\partial^2 h}{\partial t^2} \dots (1)$$

$$A(C) = \frac{\partial C}{\partial t} + \frac{\partial}{\partial x} (V_x C) + \frac{\partial}{\partial y} (V_y C) - \frac{\partial}{\partial x} (D_{xx} \frac{\partial C}{\partial x} - D_{xy} \frac{\partial C}{\partial y}) - \frac{\partial}{\partial y} (D_{yx} \frac{\partial C}{\partial x} + D_{yy} \frac{\partial C}{\partial y}) + R_c - Q_c = 0 \dots (2)$$

Where:

$$V_x = -1/b \frac{\partial}{\partial x} (T_{xx} h)$$

$$V_y = -1/b \frac{\partial}{\partial y} (T_{yy} h) \dots (3)$$

$$D_{xx} = \alpha L (V_x^2 / V) + \alpha T (V_y^2 / V)$$

$$D_{yy} = \alpha T (V_x^2 / V) + \alpha L (V_y^2 / V) \dots (4)$$

$$D_{xy} = \alpha L \alpha T (V_x V_y / V)$$

with initial and boundary conditions:

$$h(x, y) = h_0 \quad C(x, y) = C_0 \quad \forall \quad 0 \leq x \leq L, \quad 0 \leq y \leq W$$

V. CROP PATTERN MODEL

Let Y_j = Annual yield hectare of j_{th} season

P_j = Price in rupees/kg of j_{th} season

A_j = Command area under j_{th} crop

The Annual Return will be given by following equations

$$\sum (Y_j P_j A_j) \text{ for } j=1 \dots 2 \dots 3 \dots 4 \dots \text{to } J \quad (1)$$

$$\sum 0.3 (y_j p_j) A_j \quad (2)$$

Therefore gross formula for benefit:

$$\sum (1.03) (Y_j P_j A_j) \dots (3)$$

$$\sum 1.03 (W_j - A_j) \text{ for } j=1 \text{ to } j \dots (4)$$

$$W_j = Y_j - P_j$$

4. Mathematical Model for Ground Water Flow

The ground water flow problem can be modelled by:

$$\nabla \cdot \nabla \phi(x, z) = 0, \quad d \geq 0 \dots (1)$$

$$0 < x < L, \quad -\infty < z < g(x), \quad g(x) = -[(\alpha x / L) + V \sin(2\pi n x / L)]$$

with boundary conditions:

$$\phi_x(0, z) = \phi_x(L, z) = 0$$

$$\phi \text{ is bounded and } \phi(x, z) = z \text{ on } z = g(x). \quad e^{dx}$$

The solution will be of the type:

$$\phi(x, z) = \sum P_m \cos(m\pi x / L) e^{P_m z} \quad m=0 \text{ to } \infty$$

$$P_m = 1/2 [-d + \sqrt{d^2 + 4m^2\pi^2 / L^2}]$$

$$P_m > 0$$

VI. CHOLESTEROL PROBLEM MODEL

Cholesterol problem in arteries will be handled by the following equations:

$$\frac{\partial^2 u}{\partial r^2} + 1/r \frac{\partial u}{\partial r} = 1/\mu \frac{\partial p}{\partial z}, \quad \frac{\partial u}{\partial t} = 0 \dots (1)$$

$$\frac{\partial C_1}{\partial t} + \mu \frac{\partial C_1}{\partial z} = d(\frac{\partial^2 C_1}{\partial r^2} + 1/r \frac{\partial C_1}{\partial r} + \frac{\partial^2 C_1}{\partial z^2}) \dots (2)$$

$$d^2 v / dr^2 + 1/r \frac{dv}{dr} - \mu / \mu_k v = 1/\mu \frac{\partial p}{\partial z}, \quad \frac{\partial v}{\partial z} = 0 \dots (3)$$

$$\frac{\partial C_2}{\partial t} + \mu \frac{\partial C_2}{\partial z} = d(\frac{\partial^2 C_2}{\partial r^2} + 1/r \frac{\partial C_2}{\partial r} + \frac{\partial^2 C_2}{\partial z^2}) \dots (4)$$

With boundary condition

$$u = v, \quad \mu \frac{du}{dr} = \mu \frac{dv}{dr} \text{ at } r = r_1, \quad V = 0$$

$$c_1 = c_2 \text{ at } d, \quad \frac{\partial c_1}{\partial r} = d, \quad \frac{\partial c_2}{\partial r} = d, \text{ at } r = r_2, \quad c_2 = c_0$$

where t is time, μ is the viscosity c_1 and c_2 are the concentration of blood and p is the pressure.

VII. MATHEMATICAL MODEL OF HIV INFECTION

$$dT_4/dt = \beta s + r T_4 v - \gamma_1 T_4 k_v T_4 v \quad t > t_0 \quad T_4(t_0) = T_4 \dots (1)$$

$$dT_i/dt = k_v T_4 v + k_v + T_4 v - \gamma_2 T_i - k_c k_v T_4 v - k_c \gamma T_4 v \quad t > t_0 \dots (2)$$

$$dv/dt = N(1-L) T_i \gamma_3 v - k_i T_i v, \quad t > t_0 \quad v(t_0) = v$$

$$\dots (3)$$

where T_4 is infected cells by $T_i(t)$ and HIV load by $v(t)$. The model explains two steady states, a trivial state (virus free) and an endemically infected steady state with infected with virus. Numerical simulation suggests that during primary HIV infection the anti HIV Cytotoxin T_4 cells activity plays a crucial role in suppressing virus load and the loss of T_4 cells at the final stage the HIV disease which is commonly associated with server T_4 lymphoid cell order than cells may be responsible for HIV production and the final stage of viremia.

VIII. MODEL FOR OPTIMIZING RENEWABLE ENERGY PRODUCTION AND DISTRIBUTION

This model explores energy supply to meet future demand and minimizing carbon emission cost.

Considering three types of power plants, solar, wind and natural gas

X_s : capacity of solar power

X_w : capacity of wind power

X_g : capacity of natural gas power

Then minimize $Z = C_s x_s + C_w x_w + C_g x_g \dots\dots\dots(1)$

1. Energy demand constraints: $x_s + x_w + x_g \geq D$ (Peak)
 2. Renewable energy target constraints: $x_s + x_w \geq P$ (Largest)
 3. Land availability constraints: $L_s x_s + L_w x_w + L_g x_g \leq L(\text{available})$
 L_s, L_w and L_g are land used for each plant.
 4. Carbon emission constraints: $E_s x_s + E_w x_w + E_g x_g \leq E$
 5. Non negative constraints : $x_s \geq 0, x_w \geq 0, x_g \geq 0$
- Solution of this LPP gives optimality mix of solar, water and wind that minimizes total cost.

IX. RESULTS AND DISCUSSIONS

It was observed that the environmental risk of AI oriented model span energy and water consumption, carbon emissions resources, extraction e-waste challenges and sunited ecological impacts from AI applications highlighting the need for sustainable AI design and energy-efficient infrastructure power is increased by renewable energy. The models, discussed in the paper collectively underscores the dual role of AI as both a critical enabler of green sustainability and a technology

requiring careful management of its ecological foot print for a sustainable Layout.

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