AI Theories

07 Science Driven AI

Application of Natural Philosophy i.e. Physics, Chemistry, Biology information into AI solution
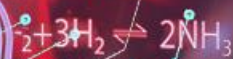
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What is Science Driven AI

When a data set is augmented by additional variables or features that comes from scientific phenomenon or domain expert knowledge

Critical Steps to create AI solution for
- Explaining the solution to make it explainable AI to have higher confidence on the result
- Stability or consistency of the solution
- Improving Accuracy
- Allows to Create solution without Real Data
- Allows to Create IoT-less Solution

Requires
- Rigorous Literature Survey
- Consulting with Domain Experts
- Extensive critical thinking

Science Based Variable can be added by
- Creating equation from the existing variables (Not Target)
- Simulation result connected to existing variables

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Example of Science Based Variable

X1	X2	X3	X4	X5	Y (Target)
5 Series	67068	125	57.6	2	11200
5 Series	62794	160	51.4	3	16000
1 Series	26676	145	72.4	1.5	12750
5 Series	35309	125	60.1	2	14900
5 Series	38538	125	60.1	2	16000
2 Series	10401	145	52.3	1.5	16250
4 Series	42668	30	62.8	2	14250
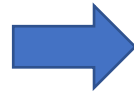
Original Variable → Scientific Variable

X1	X2	X3	X4	X5	$X2/X3^2 = X6$	$Sin(X4) = X7$	Y (Target)
5 Series	67068	125	57.6	2	4.29	0.87	11200
5 Series	62794	160	51.4	3	2.45	0.91	16000
1 Series	26676	145	72.4	1.5	1.27	-0.14	12750
5 Series	35309	125	60.1	2	2.26	-0.40	14900
5 Series	38538	125	60.1	2	2.47	-0.40	16000
2 Series	10401	145	52.3	1.5	0.49	0.89	16250
4 Series	42668	30	62.8	2	47.41	-0.03	14250

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Practical Application: Month Ahead Dengue Case Prediction

Variable/Feature Selection using Science Based Variable
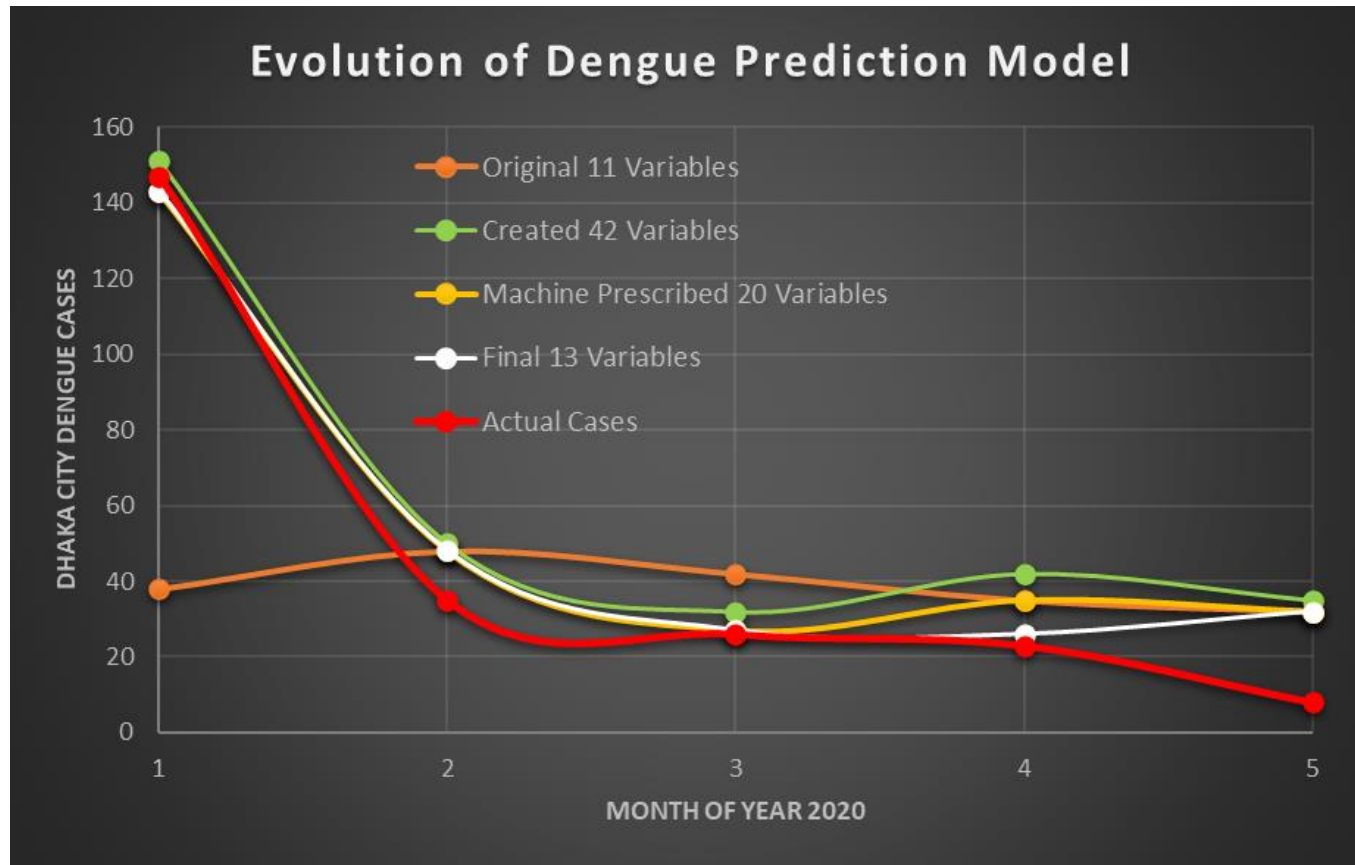
Short Term: Month Ahead Prediction using Random Forest

Improving Accuracy

	RMSE	Error MAEP
Original 11 Variables	51.0	72.8%
42 Science + Statistical Variables	16.5	29.7%
20 from Machine Prescribed	13.5	22.6%
Manual Parametric Study 13 Final Variables	12.4	18.8%

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Practical Example of Science Driven AI

Original Variables (11)

- **Dengue Cases from Hospitals**

- **Weather**
  - Min-Max Temperature
  - Humidity
  - Rainfall

- **Mosquito Survey**
  - No. of Houses and +ve Houses
  - No. of +ve Wet Containers
  - Larvae-Pupa Estimate
  - Aedes Population

A priori Knowledge from Epidemiological Variables (10) or Science Driven Variable

- **Previous Dengue Cases**

- **Weather**
  - Lagged Average Temperature
  - Diurnal Temperature Range (DTR)
  - Temp Intensity Category (high, low mid)
  - Breeding Suitability Temp Categories

  } Epidemiologist

  - Avg-Temperature * DTR

  } Journal Paper

  - Rainfall Function

- **Mosquito Survey**
  - Breteau index
  - House Index
  - Container Index
  - Pupa Index

  } Etymologist

Final 13 Variables

- **Month**
- **Weather**
  - *Lagged Average Temperature*
  - *Lagged Humidity Variation*
  - *Diurnal Temperature Range (DTR)*
  - *Variation of Avg-Temperature * DTR*
  - *Rainfall Function*
  - *Temp Intensity Category (high, low mid)*
  - *Breeding Suitability Temp Categories*
- **Mosquito Survey**
  - Lagged Variation of Breteau index
  - Lagged Variation of House Index
  - Derivative of Container Index
  - Lagged Pupa Index
- **Hospital Recorded Monthly Dengue Cases**

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