



PhUSE US Connect 2019

Paper ML01

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# **Artificial intelligence and Healthcare**

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# Agenda

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- ❖ Introduction
- ❖ Overview of Deep Learning, Machine Learning and AI
- ❖ Regression and Classification Trees using PROC HPSPLIT
- ❖ Some of the potential areas for AI
- ❖ Syneos Health initiatives
- ❖ Conclusion

# Which of the two poems below has been written by a computer?

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## Poem A:

Red flags the reason for pretty  
flags.  
And ribbons.  
Ribbons of flags  
And wearing material  
Reason for wearing material.  
Give pleasure.  
Can you give me the regions.  
The regions and the land.  
The regions and wheels.  
All wheels are perfect.  
Enthusiasm.

## Poem B:

A wounded deer leaps highest,  
I've heard the daffodil I've heard  
the flag to-day  
I've heard the hunter tell;  
'Tis but the ecstasy of death,  
And then the brake is almost  
done,  
And sunrise grows so near  
sunrise grows so near  
That we can touch the despair  
and  
frenzied hope of all the ages

<https://ideas.ted.com/was-this-poem-written-by-a-computer-or-human/>

# The Answer is ...

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## Poem A:

Red flags the reason for pretty  
flags.  
And ribbons.  
Ribbons of flags  
And wearing material  
Reason for wearing material.  
Give pleasure.  
Can you give me the regions.  
The regions and the land.  
The regions and wheels.  
All wheels are perfect.  
Enthusiasm. – **Gertrude Stein**  
**(1874-1946)**

## Poem B:

A wounded deer leaps highest,  
I've heard the daffodil I've heard the  
flag to-day  
I've heard the hunter tell;  
'Tis but the ecstasy of death,  
And then the brake is almost done,  
And sunrise grows so near  
sunrise grows so near  
That we can touch the despair and  
frenzied hope of all the ages - **Ray**  
**Kurzweil's Cybernetic Poet**  
**(RKCP)**

### RKCP Version 1: Mid 1980s

Based on simple markov-like models (similar in neural nets) to create language models of how the analyzed poets used words and word sequences, and then to write original poetry using these models.

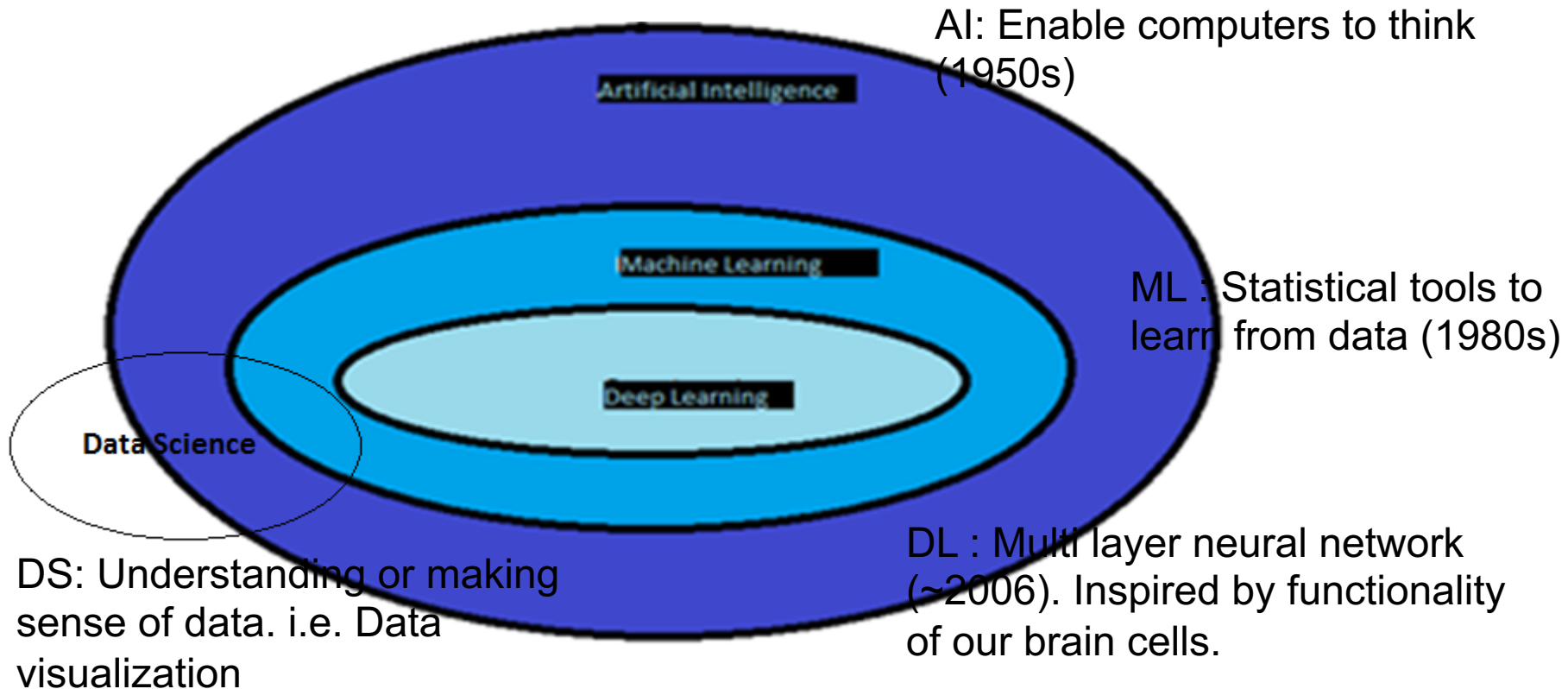
# Introduction

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- ❑ It's not about making better decisions; it's about having better information.
- ❑ In many pressing medical problems, the answers to knowing whom to treat, when to treat, and what to treat with, might already be in your data.
- ❑ Identify long-term pattern and detect improvements that would help in decision making.
- ❑ Contribute in promising areas like Clinical decision support, early insights, and risk scoring.
- ❑ Revolutionize patient care and better clinical solutions.

# Overview of Deep Learning, Machine Learning and AI

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DL is a subset of ML, which is also a subset of AI.

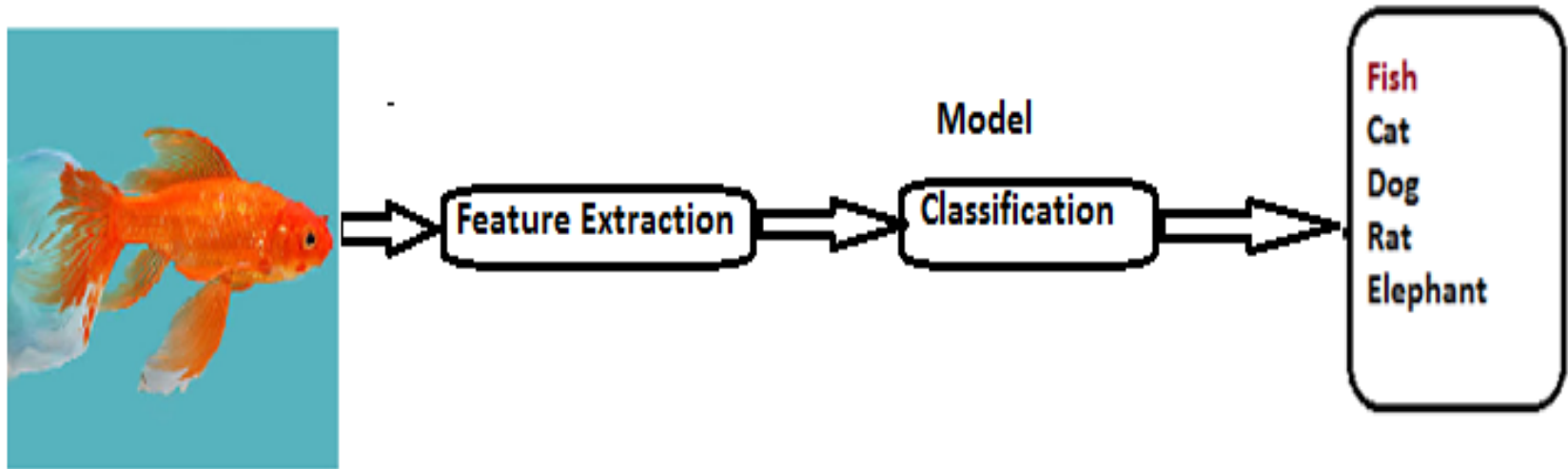
# Deep Learning vs Machine Learning

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- ✓ Data Dependency – Performance when data gets big
- ✓ Hardware Dependency – GPUs (High end machines)
- ✓ Feature Engineering – domain knowledge to reduce complexity of data
- ✓ Problem solving approach (Object detection/recognition vs end to end)
- ✓ Execution time
- ✓ Interpretability (Interpret the reasoning behind)

# Machine Learning

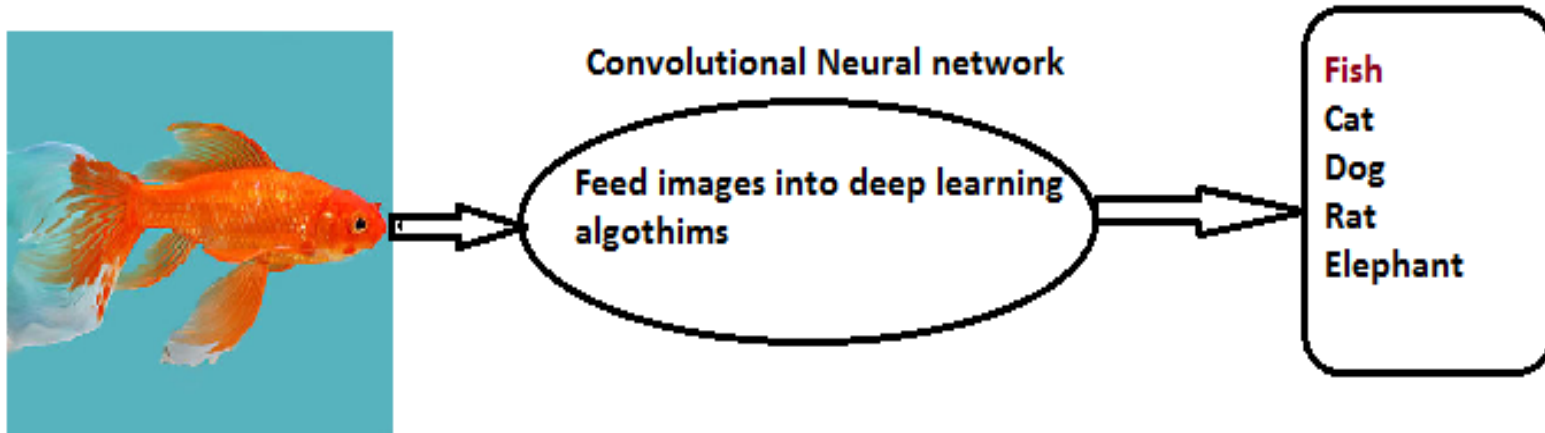
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- ✓ Start with an image and extract relevant features from it.
- ✓ Create a model that describes and predicts an image.
- ✓ Finds hidden insights in data without explicitly being told where to look or what to conclude.

# Deep Learning

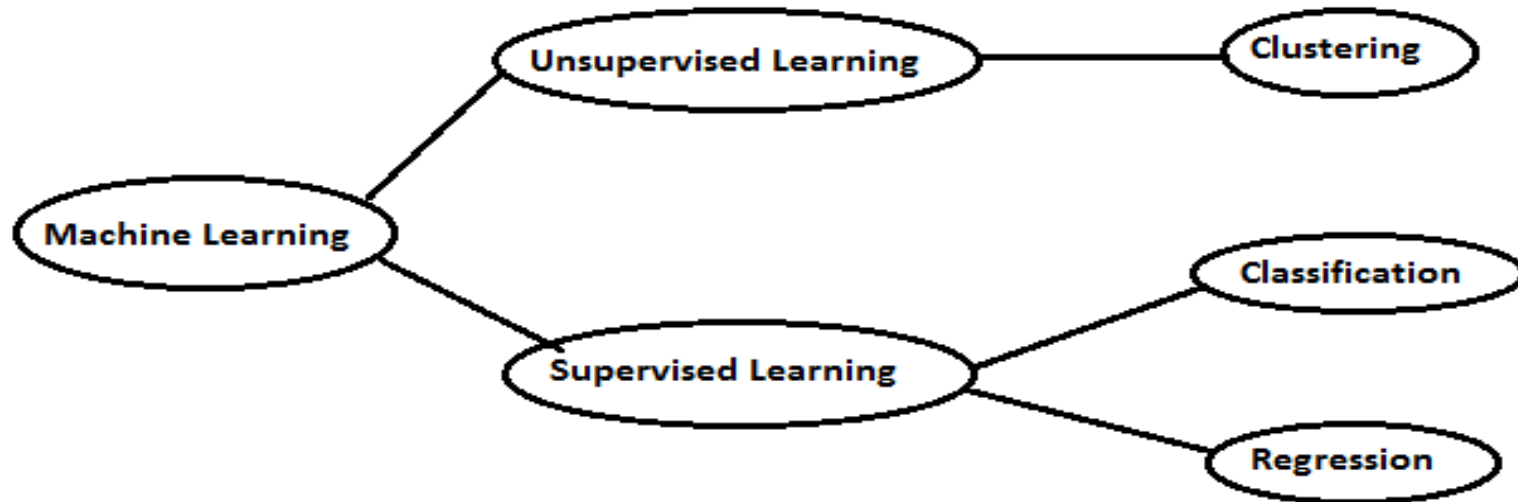
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- ✓ Skip the manual step of extracting features from images
- ✓ Feeds images directly to deep learning algorithms which then predict the object.

# Machine Learning (Supervised vs Unsupervised Learning)

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Machine learning algorithms are divided into many categories, of which supervised and unsupervised learning techniques are most widely applied in other disciplines, particularly in data mining.

# Machine Learning (Supervised vs Unsupervised Learning)

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## Examples of Supervised and Unsupervised Machine Learning Algorithm

### Supervised

- \* Bayesian Statistics
- \* Decision Trees
- \* Forecasting
- \* Neural Networks
- \* Random Forests
- \* Regression Analysis
- \* Support Vector Machines (SVM)

### Unsupervised

- \* Affinity Analysis
- \* Clustering
- \* Clustering: K-Means

- ✓ In supervised learning the machine is taught by example. Examples of the desired inputs and outputs are provided. The algorithm uses this input to determine correlations and logic that can be used to predict the answer.  
Practical Application: Fraud detection, Image and speech recognition etc.
- ✓ In unsupervised learning, the machine studies data to identify patterns. In this case, there is no answer key. The machine determines correlations and relationships by parsing the available data.  
Practical Application: Market Analysis, Identifying Like things etc.

# Regression and Classification Trees

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## Regression Tree Example using HPSPLIT : Coronary Heart Disease (CHD)

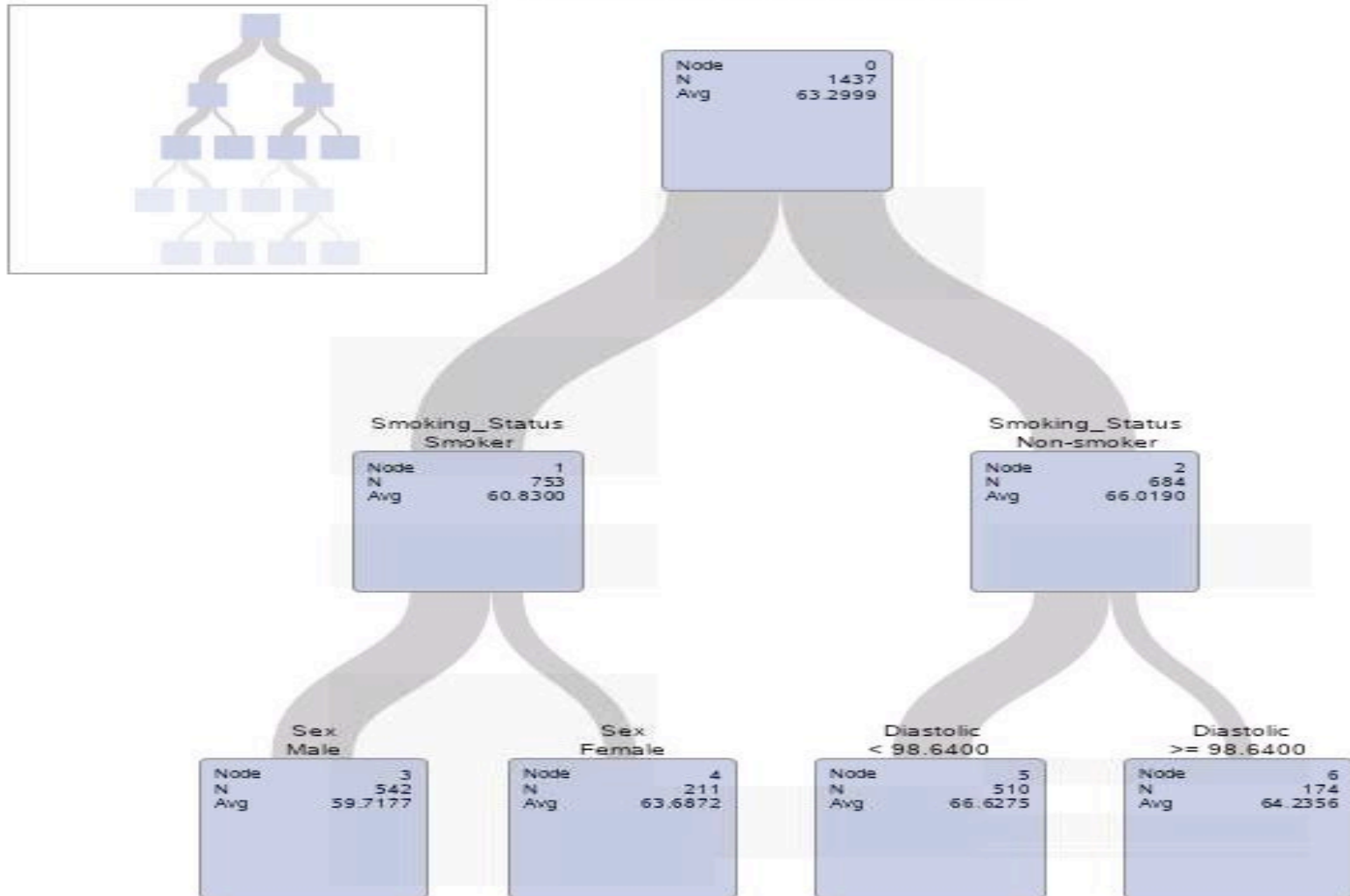
Predicting the factors that influence the chances of CHD at an earlier age can help us to understand the influence of some risk factors that drive CHD in people.

```
data heart;
set sashelp.heart;
where AgeCHDdiag ne .;
if Smoking>0 then Smoking_Status='Smoker';
if Weight_Status ne 'Normal' then Weight_Status='Abnormal';
if Chol_Status ne ( 'High') then Chol_Status='Normal';
bmi=weight/(height)**2*703;
run;
```

```
proc hpsplit data=heart seed=123 plots = zoomedtree(nodes = ("0") depth = 2 fracprec = 4
predictorprec = 4) nodes ;;
class sex Smoking_Status Weight_Status BP_Status Chol_Status ;
model AgeCHDdiag = sex bmi Smoking_Status Weight_Status BP_Status Chol_Status Systolic
Diastolic ;
output out=regout;
run;
```

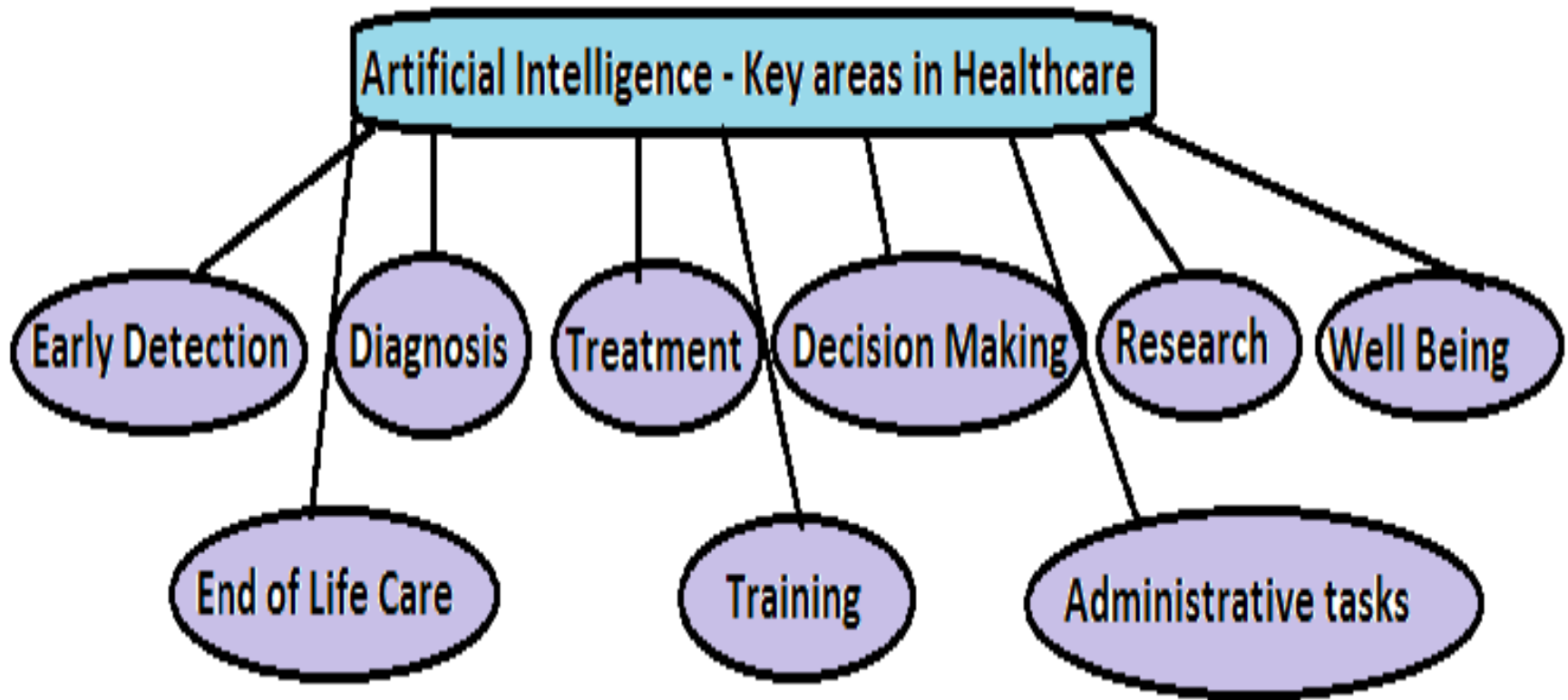
# Regression and Classification Trees using PROC HPSPPLIT (cont.)

Subtree Starting at Node=0



# Potential areas for AI

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## Potential areas of AI (cont.)

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- ❖ **Research – Drug Development**
- ❖ **Diagnosis – Medical imaging Diagnostics**
- ❖ **Well Being**
  - ✓ Electronic Health Record
  - ✓ Virtual Health Assistance
- ❖ **Treatment – Robotic Assistance**
- ❖ **Early Detection – Proactive Medical Care**
- ❖ **Decision making and Diagnosis**
- ❖ **Administrative Tasks and Training**
- ❖ **End of Life Care**

## Syneos Health - ML and AI related initiatives

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- Syneos Health Biometrics and Business Technology are currently working on a number of Proof of Concept projects with some of our internal teams and technology partners to establish and test real world use cases for Machine Learning and AI initially to drive task automation into process automation and metrics and data insights
- The projects are focused on a broad range of use cases to test the technologies ability to deliver actual benefit and ensure that we are not just chasing the latest trend in new technology
- Our strategy is to evaluate the technology in real world applications to add value to our processes and for our customers as we move forward with these tools

## Syneos Health - ML and AI related initiatives

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To know more about AI and Machine Learning related Syneos initiatives please contact :

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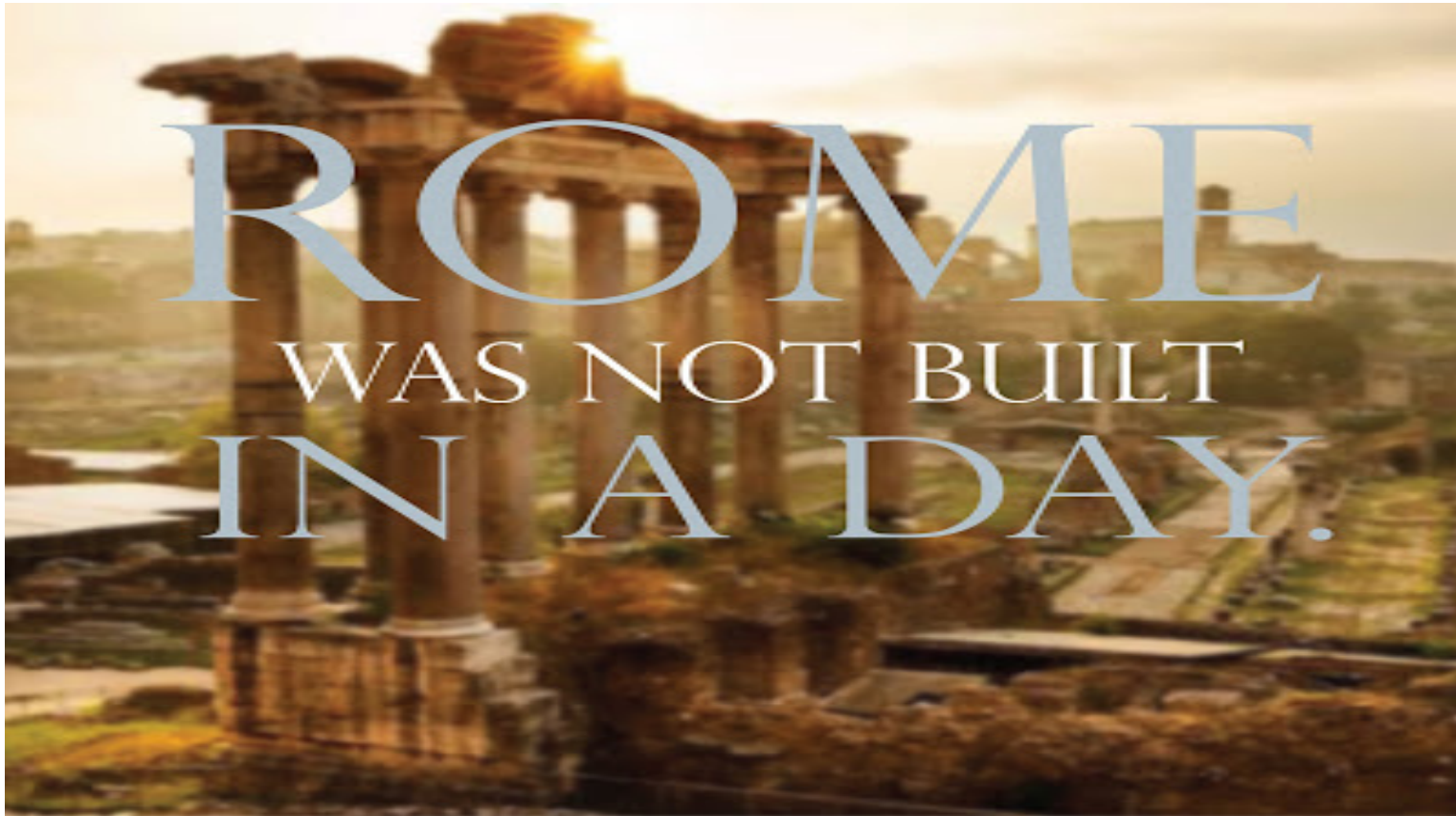
# Conclusion

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- ❑ It's not about making better decisions; it's about having better information.
- ❑ AI is changing overall healthcare in diagnosis, treatment, disease detection including role of the doctors and patients.
- ❑ Some challenges that need to be addressed
  - ❖ Risks i.e. wrong predictions, safety, data security, new and exceptional cases
  - ❖ Patient and doctors comfort level in using the AI systems
  - ❖ Training and expertise to use AI systems
  - ❖ Adherence to healthcare regulatory standards
- ❑ New generation of AI-related tools and systems will help healthcare providers provide efficient care and get ahead in diagnosing and preventing thus creating a new era of clinical quality and exciting breakthroughs in patient care. But Rome wasn't built in a day...

## Conclusion

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# Acknowledgements

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