Creating an Analytics Learning System

Eduardo Rodriguez PhD
Sentry Endowed chair in Business Analytics UWSP

Prepared for the Central Wisconsin IT Conference

October 6, 2018

Contents

1. Objectives, Clarification of Terms and Antecedents
2. Five concepts to use
3. Basics of an Analytics Learning System
4. A Model for an Analytics Learning System
5. Reflections
6. Final Remarks
7. Q&A

1. Objectives, Clarification of Terms and Antecedents

- Objectives:
  - Understand the principles/components of analytics learning systems
  - Connect analytics learning systems and actions
- Clarification of terms
  - This presentation is not about D2L, Blackboard, Moodle… learning systems
  - This presentation is about the interaction of Statistical Learning, Machine Learning and Organizational (Business) Learning

1. Objectives, Clarification of Terms and Antecedents

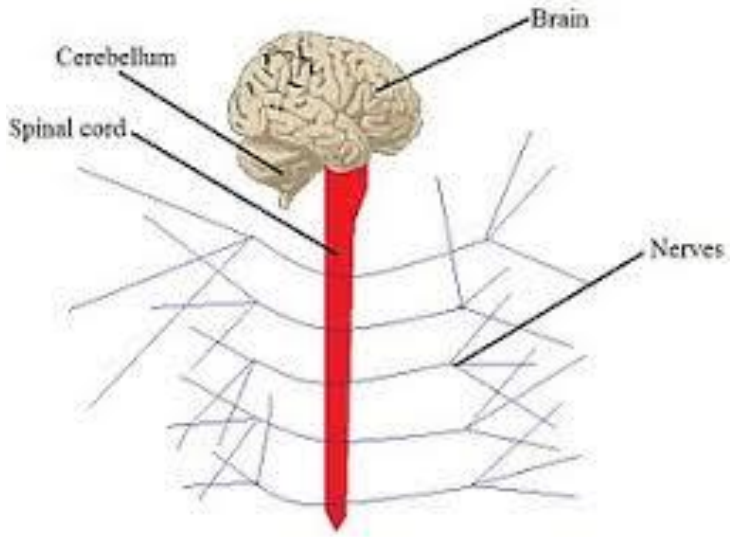
- We have been talking for hundreds of years about learning and knowledge management. Machine Learning, Statistical Learning and Organizational Learning emerge from various scientific roots.
- Each one has a specific jargon, methods, tools, and conceptualization process. However, the purpose is one: Understand the learning process and how to create valuable knowledge.
- Organizations need to improve computational capacity and discover methods for solving more complex problems to be more intelligent.
- Organizations need to find the way to use the huge arsenal of methods for strengthening people's action to add value to their work.
- This talk concentrates on value creation through knowledge, meaning development, understanding improvement for supporting problem-solving and decision-making processes in organizations.

2. Five concepts to use

A- system

Ackoff's System definition (Ackoff, 1981, pp. 15-16):
"A system is a set of two or more elements that satisfies the following conditions:

- The behaviour of each element has an effect on the behaviour of the whole
- The behaviour of the elements and their effect on the whole are interdependent
- All possible subgroups of elements also have the first two properties"



We use component instead of element
Knowledge Discovery/Creation plus Innovation and Actions to intervene in the Reality Creation. It is more than adaptation it's to build the Reality!

2. Five concepts to use

B- Learning

(This is an example of omitting machines!!!!)

“Learning is defined as a process that brings together personal and environmental experiences and influences for acquiring, enriching or modifying one’s knowledge, skills, values, attitudes, behaviour and world views. Learning theories develop hypotheses that describe how this process takes place. The scientific study of learning started in earnest at the dawn of the 20th century. The major concepts and theories of learning include behaviourist theories, cognitive psychology, constructivism, social constructivism, experiential learning, multiple intelligence, and situated learning theory and community of practice.”

Unesco

2. Five concepts to use

- Statistical Learning
- Machine Learning
- Organizational Learning

I am trying to learn!!!

- This was what a machine said to another machine!!!
- This was what a human said to another human!!!!
- This is what a human said to the machine and
- This is what the machine said to a human

And this is what I said to myself!

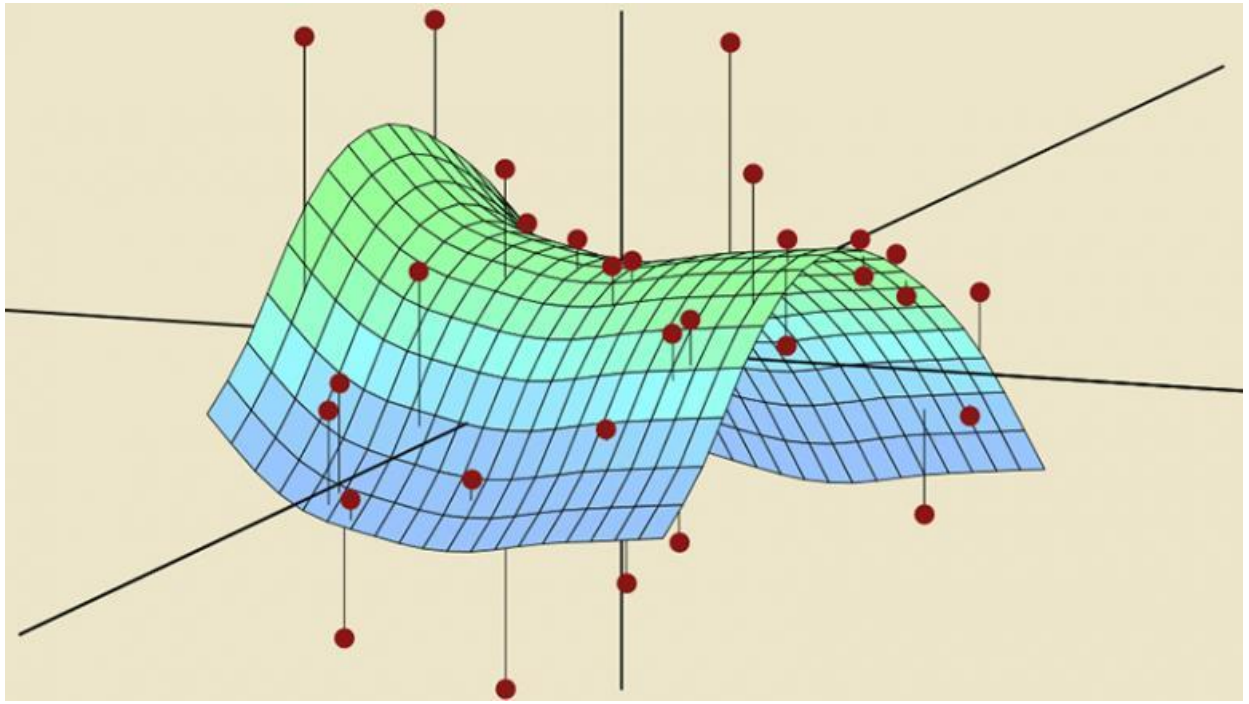
I want to learn: what problem to solve, what framework to use, what method to use to approach a solution, what I have to observe/review, what I need to understand/interpret and what I could say to complement other solutions

2. Five Concepts to use

C- Statistical learning

"Statistical learning refers to a set of tools for modeling and understanding complex datasets. It is a recently developed area in statistics and blends with parallel developments in computer science and, in particular, machine learning. The field encompasses many methods such as the lasso and sparse regression, classification and regression trees, and boosting and support vector machines."

James G., Witten D., Hastie T., and Tibshirani R. (2013) An Introduction to Statistical Learning, Springer

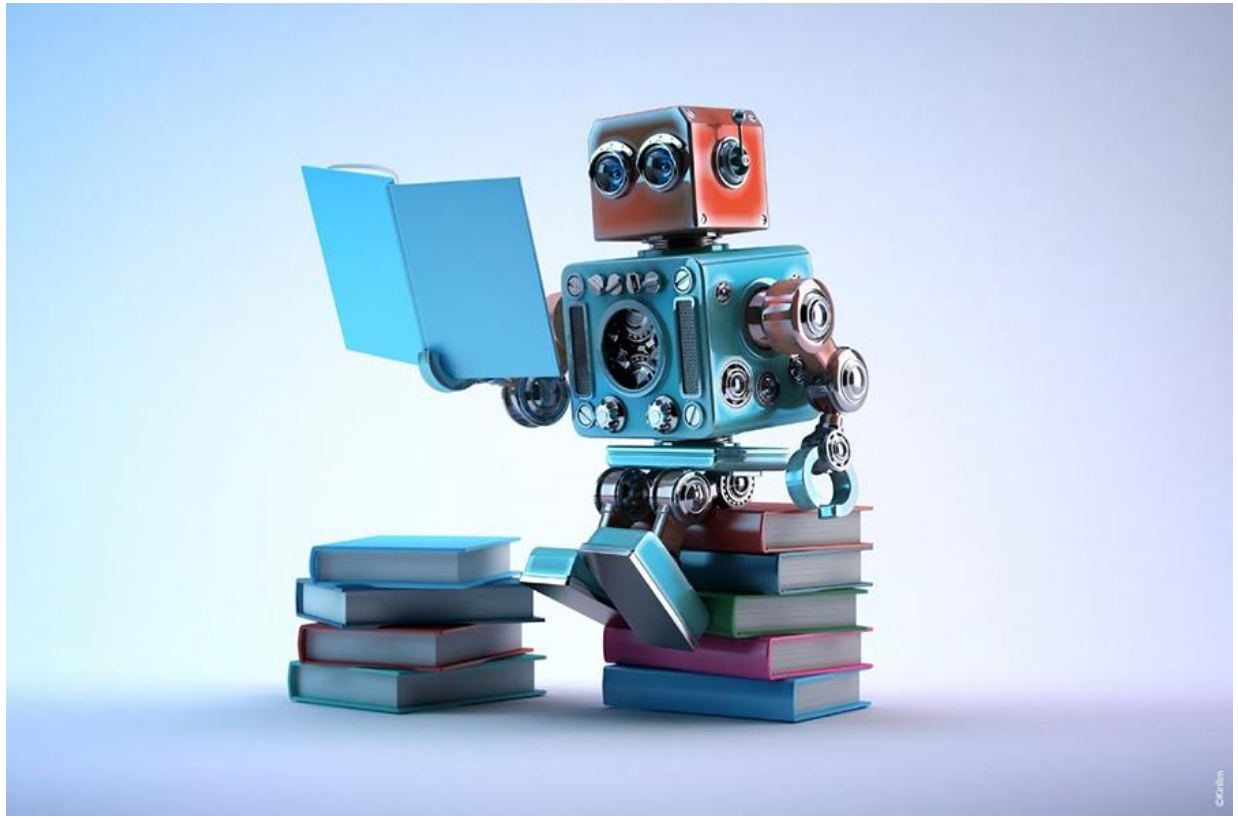


2. Five concepts to use

D- Machine Learning

"The field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience."

"How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?"



Mitchell T.M. (1997),Machine Learning, McGraw-Hill

2. Five Concepts to use

E- Organizational Learning

"Although learning occurs at different levels of analysis in organizations, the knowledge acquired from learning must be embedded in an organizational repository in order for organizational learning to occur. Learning generally occurs through individuals in organizations."

Linda Argote (2013), Organizational Learning Creating, Retaining and Transferring Knowledge, Springer

"Single-loop learning asks a one-dimensional question to elicit a one-dimensional answer…Double loop learning takes an additional step or,… it turns the question back on the questioner."

Argiris 1994 Good communication that blocks learning, HBR

3. Basics of an Analytics Learning System

- Language
- The analytics process
- Learning is a continuous
- Observing the VIBO model

Keep in mind a Principle of Machine Learning that is applicable to all three statistical, machine and organizational learning:

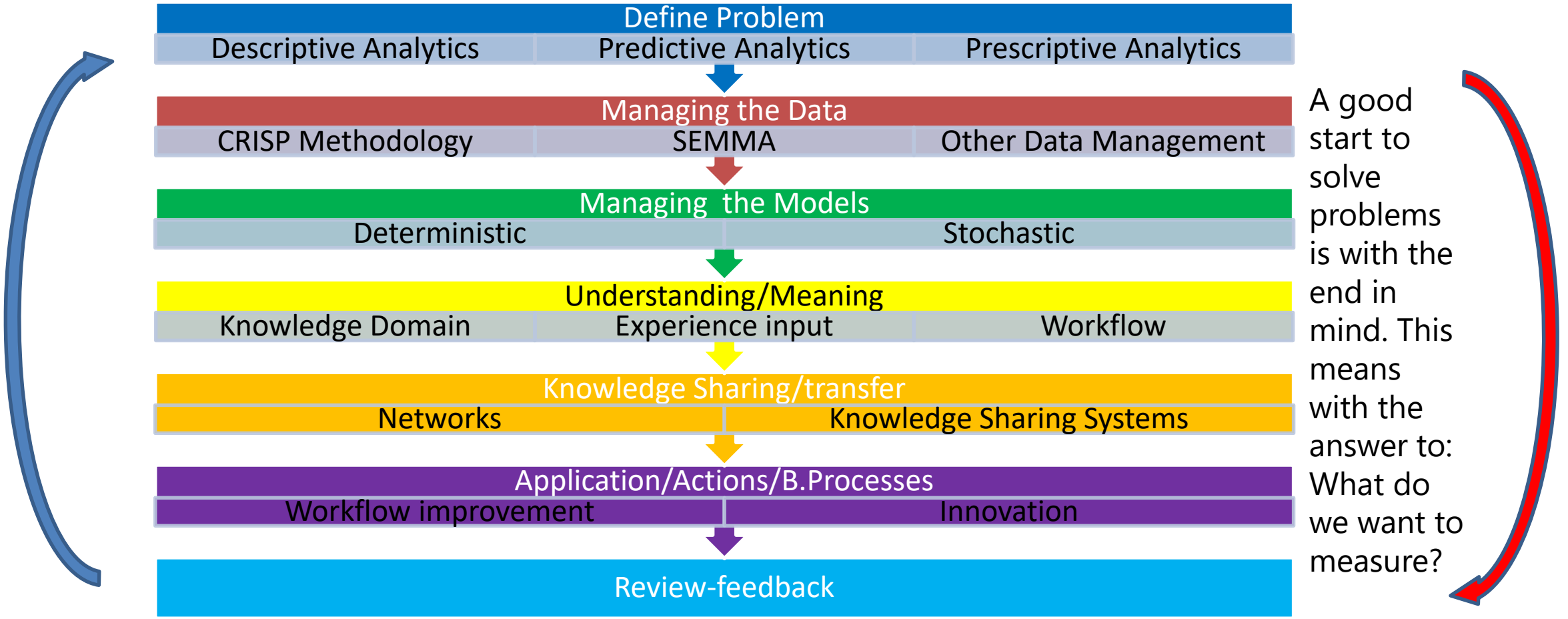
"A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." **Mitchell T. 1997 Machine Learning, McGraw-Hill**

3. Basics of an Analytics Learning System
Why do we need a more integral view?
Issues with language

- **Machine Learning**
  - Induction
  - Learning
  - Classification/patterns
  - Non parametric/Empirical
  - All data
  - Attribute
- **Statistics**
  - Inference
  - Estimation
  - Discriminant Analysis
  - Mathematics based / parametric
  - Limited data/invent samples
  - Variable

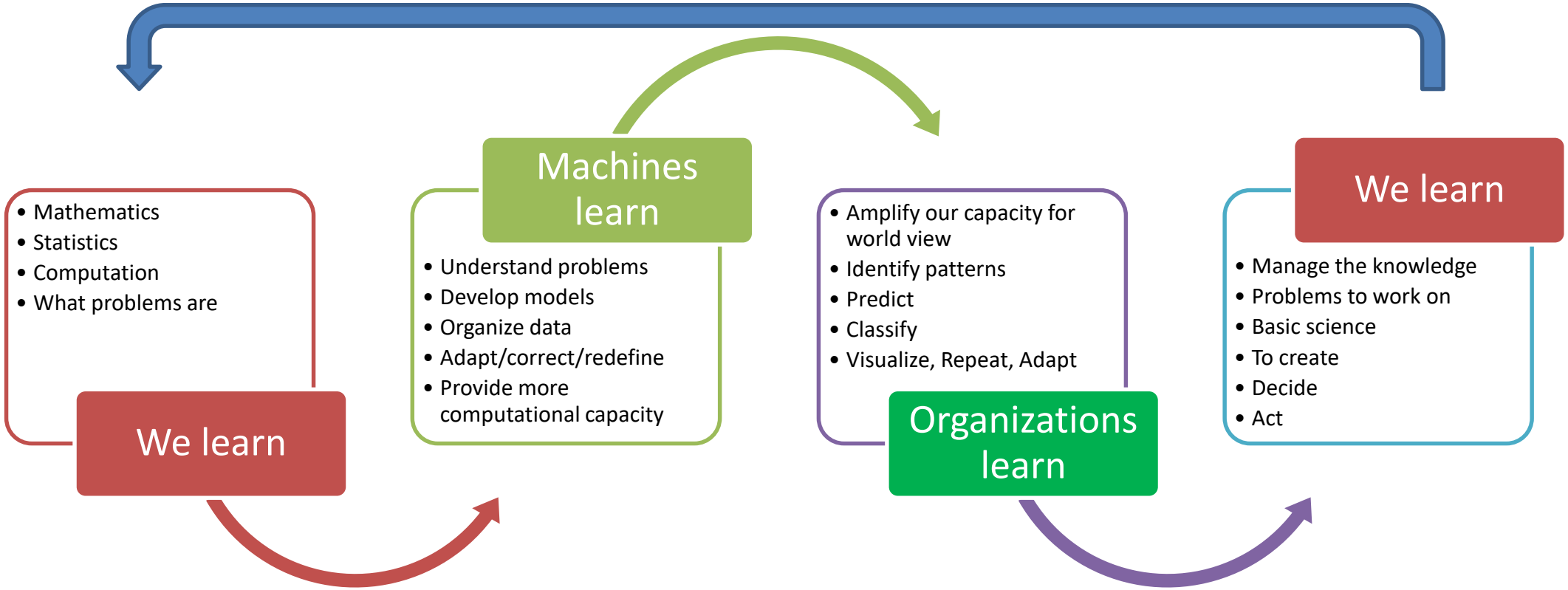
In any case the project/study/research to learn/know has to be planned, organized, data needs to be gathered cleaned, filtered…

3. Basics of an Analytics Learning System
The Analytics Process



A good start to solve problems is with the end in mind. This means with the answer to: What do we want to measure?

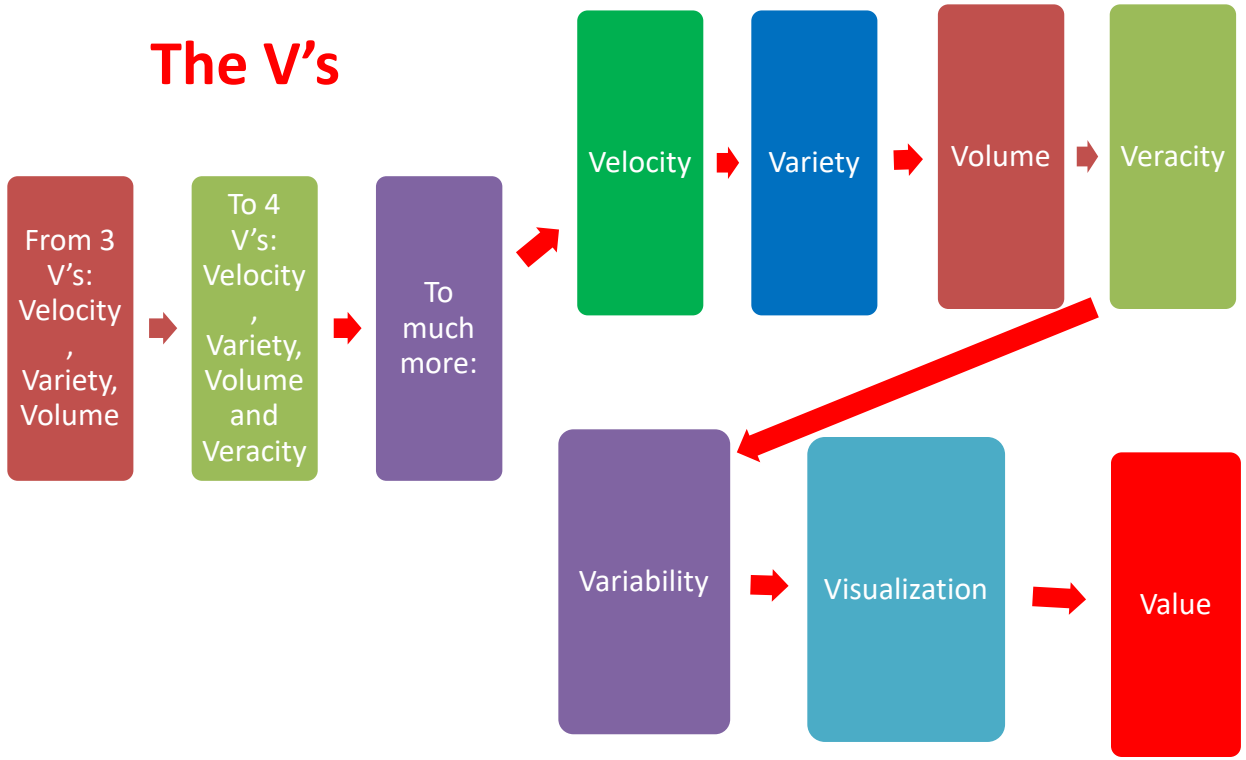
3. Basics of an Analytics Learning System
Perpetual chain for analytics learning and use…



3. Basics of an Analytics Learning System
The VIBO™ Model

The VIBO Model is a conceptual model to frame what the Analytics Process requires to be implemented

V are the V's of Big Data - **I** are the I's related to Impact - **B** are the B's related to Business - **O** are the O's related to the Organization/Operation



The I's

- Impact / Application and usability
- Identification / Management of scale/Problem definition
- Intelligence / Formal research process/Risk Control
- Interpretation / Context and application
- Importance / Bias analysis-good sampling
- Interest / Expected value
- Integrity / Data cleaning-organization
- Integration / Accommodate data/people properly
- Improvement / Ensuring continued results
- Inherent / Guided by organizational processes/Risk Control

3. Basics of an Analytics Learning System
The VIBO™ Model

Transformation of V's into B's

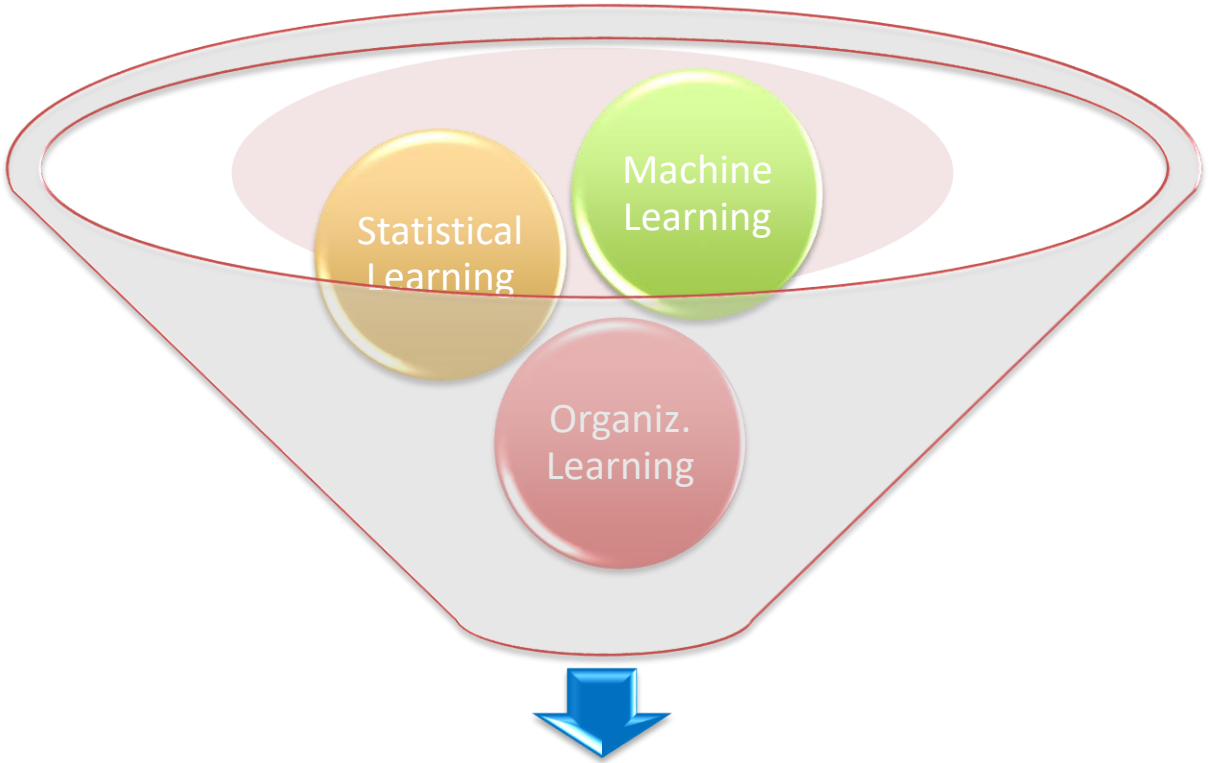
1. Business development
2. Benefit creation
3. Barriers overcome
4. Boundaries definitions
5. Background support
6. Bridging and connectivity
7. Building on results
8. Benchmark for everything
9. Boards of directors understanding
10. Behaviour of ongoing learning

BUSINESS

The O's of Organization's Structure

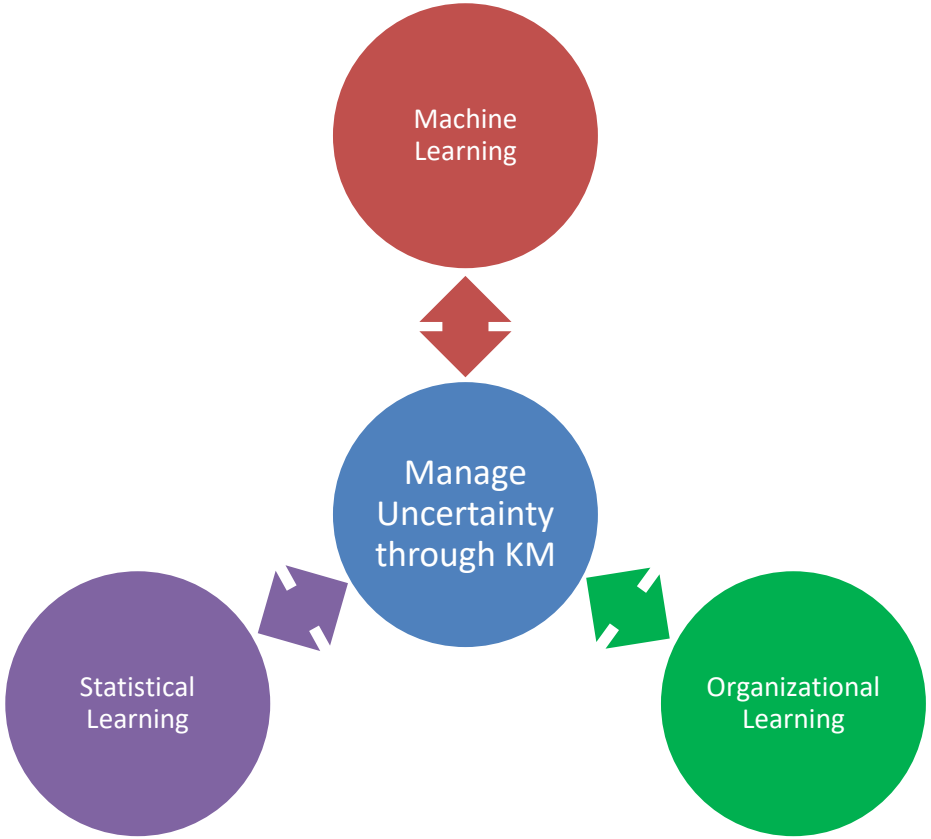
4. A Model for an Analytics Learning System

How to integrate the pieces of the puzzle?



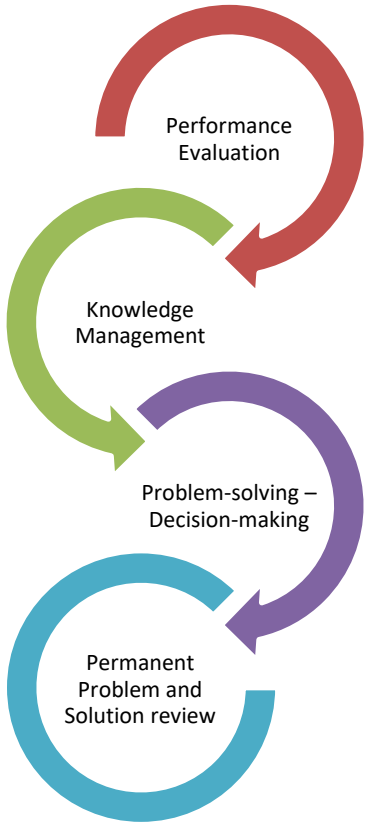
Learn – Create knowledge/understanding to be/live better

4. A Model for an Analytics Learning System
The Analytics Molecule Model is the structure of an Analytics Learning System

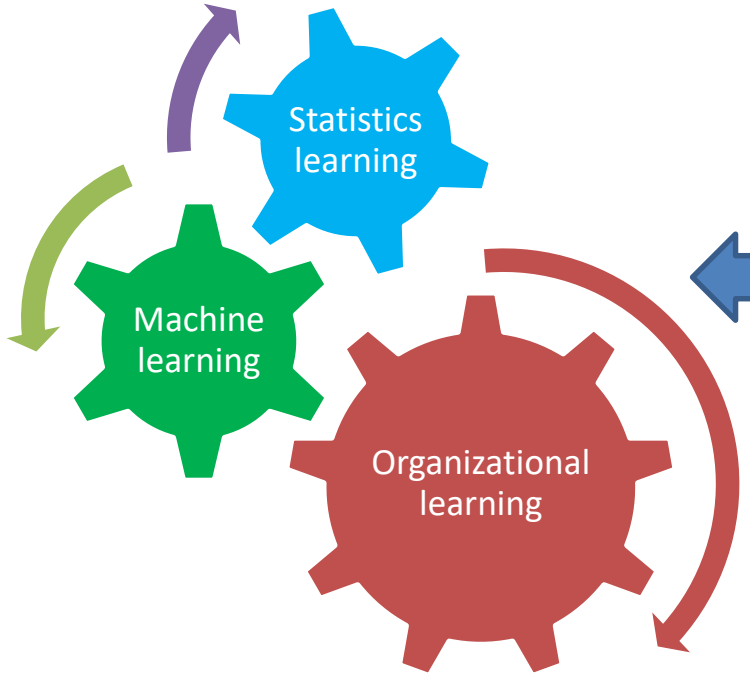


4. A Model for an Analytics Learning System
An Analytics Learning System

The basic steps to start - what we seek with analytics



What we need to learn Synchronization

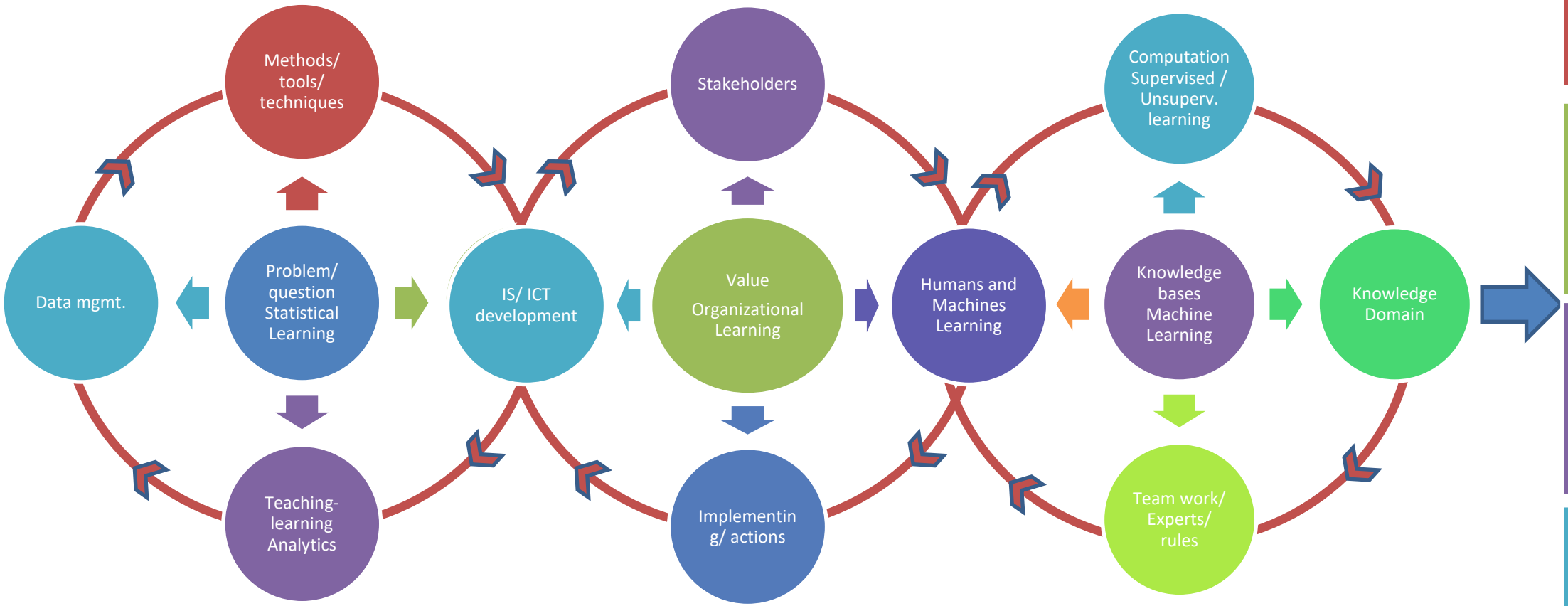


- Analytics Knowledge Creation
- Analytics Knowledge storage/ access
- Analytics Knowledge Transfer
- Analytics Knowledge Applic.

Meaning/understanding/innovation

4. A Model for an Analytics Learning System

The Molecule Model for an Analytics Learning System



Analytics Knowledge Creation

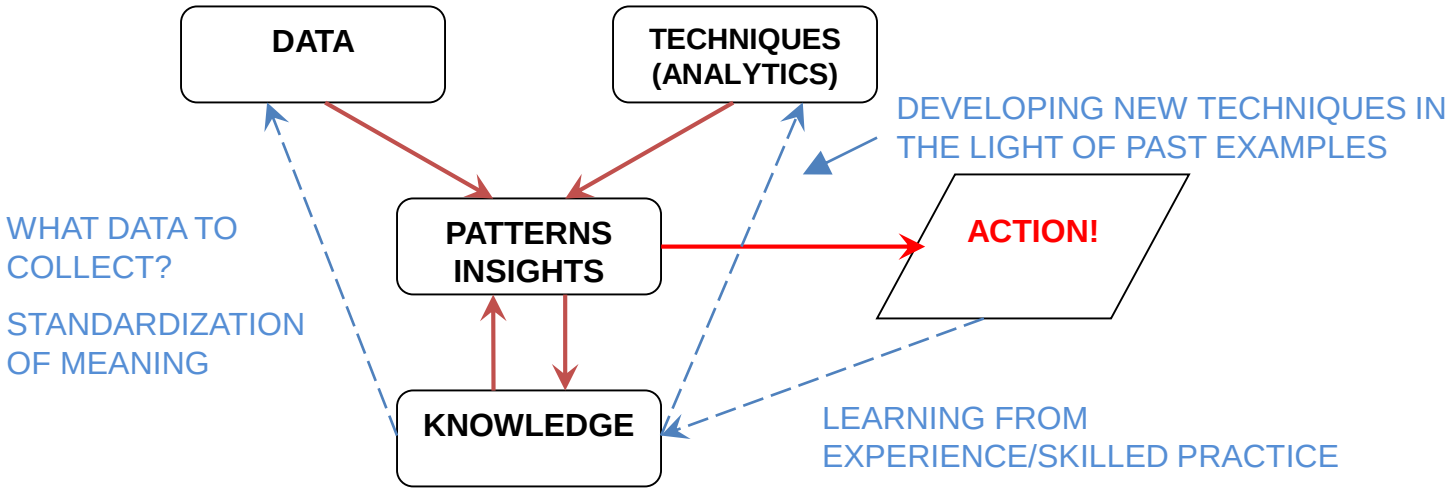
Analytics Knowledge storage/ access

Analytics Knowledge Transfer

Analytics Knowledge Applic.

Innovation

4. A Model for the Analytics Learning System
The molecule model works through the Interactions: Data – Techniques and Knowledge



Edwards, J. S., & Rodriguez, E. (2016). Using knowledge management to give context to analytics and big data and reduce strategic risk. Procedia Computer Science, 99, 36-49. doi: 10.1016/j.procs.2016.09.099

5. Reflections
The Analytics Learning Systems require people's skills

"the emphasis is on how to prepare analytics students to convert data into actions and solutions implementation." and we said "The main idea is to develop the skills to move from Know-What (problems and possible methods to solve them) and Know-Why (identification of possible sources of variation of results) to the Know-How to perform the analytics process (the value and impact of possible implementation of solutions) (Garud 1997)."

Rodriguez E., Edwards J.S., Ramirez G.(Forthcoming) Vowels S. and Goldberg K., Competencies for the design, implementation, and adoption of the analytics process, CRC Press

5. Reflections
The Analytics Learning Systems need to deal with the issue of Bias

- "Bias can appear as a result of wrong use or interpretation of metrics, from lack of analysis of the distribution of the variables, or from an inappropriate design of experiments and sampling process, among many other causes. For instance, people's first choice for describing the behaviour of a variable is to use the arithmetic mean/average…"
- "Alternatively, the facial recognition software may not be showing bias, but just incompetence - lack of precision, in our terms. In two tests in the UK, the Metropolitan Police (covering most of London) identified 104 people with the aid of the software, but only 2 of them were actually on their wanted lists. The South Wales Police actually went on to intervene in 46 cases, even though 31 of them turned out to be innocent people."

Bias in analytics Edwards J.S., Rodriguez E. (Forthcoming) in Babu George (Editor), Business Transformation in Data Driven Societies. Palgrave

6. Final Remarks

To build the Learning System requires to work on:

1. Aligning resources/thinking around the core = problem to solve
2. Understanding of users/use of solutions
3. Looking for more solutions / options to learn
4. Enhancing the learning chain
5. Learning and moving through the KM processes and design a KMS for analytics
6. Creating more interdisciplinary people are working in problem-solutions – the key to use equivalent “languages”

Thank you very much!

Q&A

eduardo.rodriguez@uwsp.edu

Sentry Endowed Chair in Business Analytics UWSP