Scope of the Course

- **How is ISE view of Analytics different from CS Data Science, and Marshall Analytics?**
  - CS View of Data Science: Face Recognition, Speech Recognition
  - Marshall View: Use Software (e.g. SAS) to make Business Decisions
  - ISE View: Models for Transforming Data to Decisions

- **What kind of Background?**
  - Computing: We expect students to have had some programing experience, although we will introduce students to Python and R
  - Statistics: Regression, hypothesis testing. We will go over other stat/machine learning concepts such as overfitting, generalizability and others

  - Optimization: Linear Programming, but we will introduce some Stochastic Programming models

- **Interfacing Data and Decisions?**
  - Cross-sectional Data
  - Time Series Data
  - Spatio-Temporal Data

Modern OR APPLICATIONS with Big Data and Big Decisions

Integrative Analytics

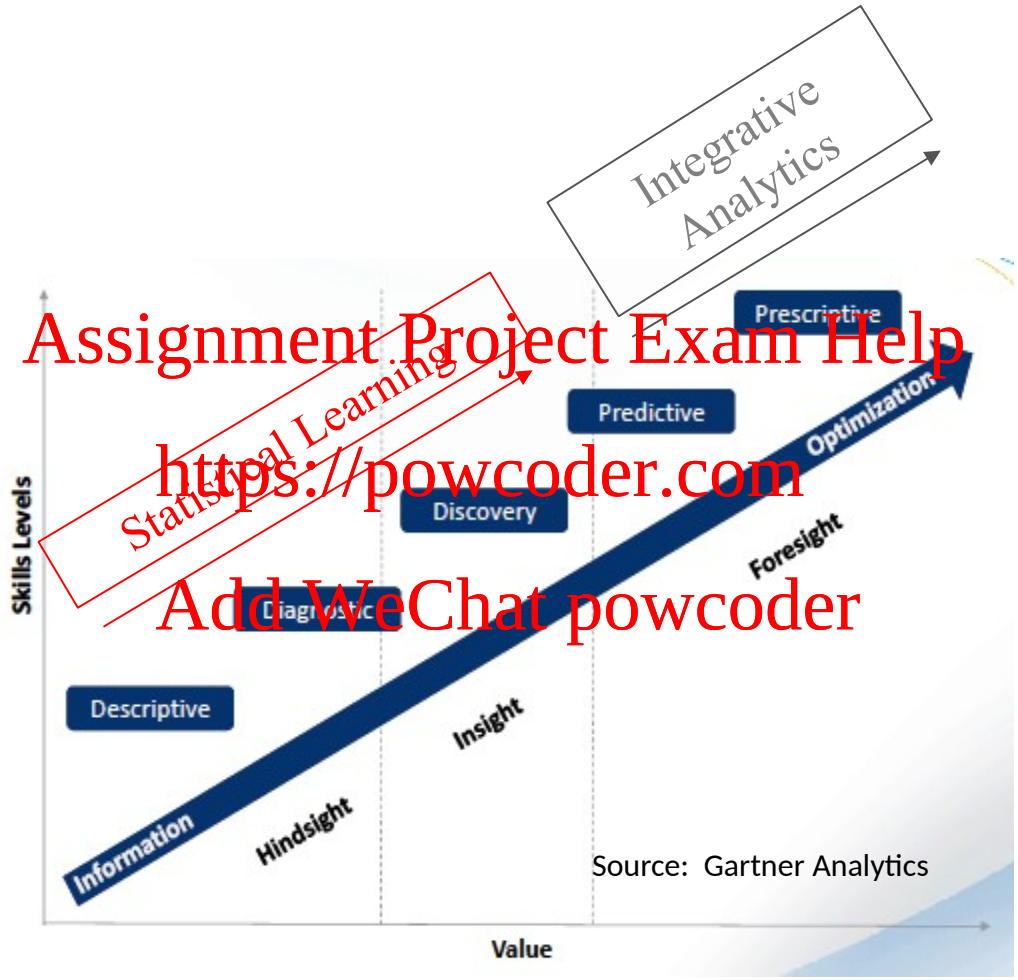
- **Coordination** of Sales, Marketing and Production (Cross-Sectional **Data**)
- Inven **Data**)

Analytics of Things (AoT)

- **Renewable Energy Integration**

Modeling Paradigm
LEARNING ENABLED OPTIMIZATION

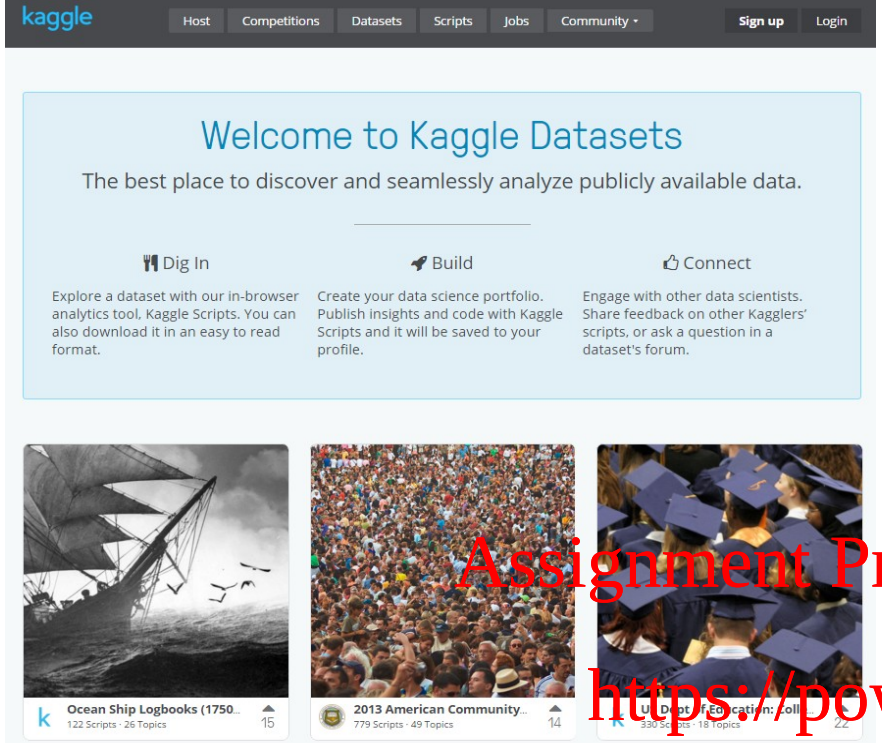
THE SPECTRUM *of* ANALYTICS



Source: Gartner Analytics

New Generation of Optimization

- Example Application: Advertising+Production Planning
  - Sales Projection based on Regression
  - Use Sales Projections (data) in Production Planning
  - How should one create a production plan when sales is forecast using regression ? (**Cross-sectional data**)
- Example Application: Inventory Models
  - Consider the "R" data set called elecequip
    - 10 years of Time Series Data
  - How should one create an optimal ordering policy when the data is a **time series**
  - Alternative types of mean-reverting processes
- Example Application: Renewable Energy
  - Wind data exhibits **spatio-temporal** (correlated) **data**
    - Validated off-line simulation can be used for simulation as a proxy for data
  - How should one use simulation wind output in a unit-commitment cum dispatch model
- Other types of Data:



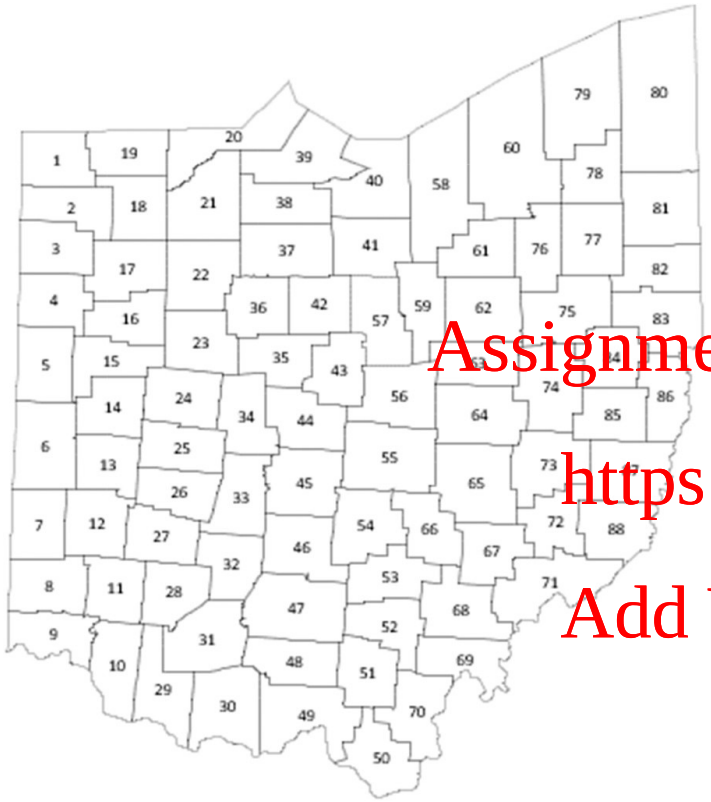
Modern data sets: all kinds of Data

- Healthcare Costs Energy Usage
- Nutrition Content College Debt
- Transportation Costs etc..

What is "Diet Problem into the New Millenium?"

The Analytics Problems of Today Ask that We Use Optimization Methodology which will put a Strong Foundation for Analytics

Ohio Banking Problem



State of Ohio, and Counties

* New law (in 1979) A Banc can put branches in any county where the bank has a principal place of business and in any county adjacent to one in which it has a principal place of business.

•**Counties in Ohio (marked by the shapes in the map)**
•**New Law (1979) ...** A Bank can put Branches in any county where the bank has a principal place of business and in any county adjacent to one in which it has a principal place of business.
•What is the minimum number of principal places of business, and in which counties should they be located to enable branches in all eighty-eight counties of Ohio?

HW 1 (For Teams of Two)

1. Using population data of Ohio counties from the data closest to the year prior to 2011, instantiate the Branch Location formulation discussed in the Tutorial by Jeff Camm.
2. Using population data for 2020, instantiate the Branch Location formulation.
3. Compare the solutions, and discuss whether the ”glide path” property presented in the paper applies to the decisions which you obtained.
4. Suppose that in 2011 you had a crystal ball into 2020, and wanted to use that population data during the 2011 run. Formulate a model that enforces the glide path property for 2020.