EAS 504 ASSIGNMENT-10

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General Information: -

The following Lecture was held by Mr. Andrew Loebs and Mr. George S. Baggs. They work as Operations Engineer and Systems Engineer respectively in MOOG and use the knowledge of predictive analytics in various domains of the company.

Base Questions: -

1.) What are principal uses of data sciences in this domain?

Ans) Following are principal uses of data science in this domain:

1. **Shop Scheduling: -** F-35 program also known as Joint Strike Fighter program is a fifth-generation stealth fighter that has huge demand (in thousands) from various countries because of which Lockheed Martin has to setup a line overhaul facility like passenger vehicles. To make the production efficient predictive analytics is used for equipment procurement and to capture the demand for different parts of the aircraft.
2. **Metal Additive (inspection): -** CNN (for Visual classification of process output) is used for analyzing metal additives manufacturing parts.
3. **Analysis of Metal Grain Structure: -** CNN is also used for automatic inspection and classification of metal grain structures.
4. **Experimental Output Analysis: -** Visual Classification of experimental outputs is done using supervised and unsupervised machine learning techniques.
5. **DOE Optimization: -** Deep Learning techniques (CNN) are used for optimization of Design of Experiments (DOE).

2.) How are data and computing related methods used in the organizational workflow?

Ans) Data and computing related methods are used in following ways in organizational workflow: -

- For ramping up the production capacity of F-35 line, three field taxonomy is implemented i.e. alpha/ beta/gamma scheduling to deliver the final product on time, identifying and reducing various other time parameters incurred during the production.
- CNN and RNN are used for recognizing the patterns in spatial and temporal data respectively during metal additive manufacturing parts process
- Unsupervised machine learning algorithm such as K-means classification response metric to quantify visual metrics.
- Analysis of Variance (ANOVA) Plots are used to observe interaction between different factors.

3.) What data science related skills and technologies are commonly used in this sector?

Ans) The data science related skills and technologies commonly used in this sector are as follows: -

- Machine Learning (Supervised/ Unsupervised methodologies)
- Pythons (Numpy, Pandas, Keras, Scipy, Scikit Learn)
- Theano (a deep learning software)
- Deep learning Techniques like CNN (spatial data) & RNN (temporal data)
- Clustering techniques like K-means (unsupervised learning)
- Statistical tests like ANOVA & ANCOVA.

4.) What are the primary opportunities for growth?

Ans) Speaker explained us about various areas where there are opportunities for growth. He explained that there are opportunities for identifying the response metrics from different sort of visual images, observed during metal engineering process. He also explained how Machine Learning can act as a surrogate for human subject matter experts (SME) to classify and rate visual responses from experiments. This will help reduce human bias.

Other Questions with respect to this Lecture: -

Ques.) In addition, describe in your own words one of the case studies that was presented and the solution that was developed to solve the problem?

Ans.) Speaker talks about bad grain identification from the top surface of the metal, this would help them identify whether right additive has been added during the metal engineering process or not.

The solution that speaker suggested is using the visual images from the top surface and analyzing it using CNN techniques and K-means Classification response metric to know whether there is a bad grain on the top surface of the metal. Using the predictive power, company has automated the process and have replaced the human bias. It has also enabled the company to understand the interaction between different factors, determined from metal engineering process.