Assignment 7

EAS 504

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Base Questions:

- What are the principal uses of data sciences in this domain?
  A. Electronic Design Automation industry uses data science for developing algorithms for statistical approaches, heuristics, predictions derived from vast volumes of data generated by tools. Machine Learning also helps to gain better insights to manage complexity growth. ML-based computing techniques are being applied to solve problems such as increased complexity of solving certain EDA problems which are pushing the limits of traditional algorithmic/heuristic approaches. Foresight apps have been developed for improving productivity, quality, HW cost.

- How are data and computing related methods used in the organizational workflow?
  A. Data and computing related methods are being used in various components in the organizational workflow such as:
     - Unified data extraction layer where raw data is collected and cleaned.
     - Unified transport layer where provenance and schema are embedded, the SSL/TLS are enabled.
     - Unified storage layer where data discovery, formulae hypothesis is carried out.
     - Core Standard Machine Learning Layer where machine learning is implemented using automated, scalable, distributed computing and also model and algorithm flows are monitored to check if the models and algorithms are accurate & deterministic, robust to outliers, actionable results are being produced and business goals are being met.
     - Applications layer where the model and business logic is implemented, usability features are tested, debugability and logging are carried out.
     - And the last layer is install/monitor where you deploy and maintain your models at customers environment with minimal setup and high availability.

- What data science related skills and technologies are commonly used in this sector?
  A. VC Formal technology is used for formal analysis of the chip, IC route prediction, Bug tagging, check-in analytics, test failure predictor, test selection, grid scheduling, failure tagging, various regression techniques are being used in ML applications, NLP (Natural Language Processing) techniques for converting English text to assertion.

- What are the primary opportunities for growth?
  A. Global Electronic Design Automation(EDA) is an industry worth approximately $5 billion worth. As more and more companies start developing semiconductor chips for their appliances they will need this ecosystem of verification systems to improve their product quality and sales so improving existing service models would lead to more growth as the company is moving from silicon to software.

Use of Machine Learning in Verification systems:

Machine Learning is being used extensively used in the Electronic Design Automation industry:

1. Dynamic Test Selection:
   - Machine Learning is used to predict test cases that are likely to fail for the changes that developers are trying to make.
   - Instead of running all the 1million test cases 5%, 3%, 2% are only run reducing the number of test run and resulting in a huge saving in time.
   - The prediction also gets better with time as the model learns from previous data.
   - The entire process speeds up.

2. Regression Test Selection:
   - Regressions verify the correctness of code-change are costly on CPU's, time and support. Expanding the regression scope also pushes the failures later in the flow.
   - With the help of machine learning models, minimal test-case sets are selected through coverage-grading. More changes that fail test-cases are checked-in.

3. Breakdown:
   - A Large number of bugs are reported daily, they needed to be routed to the right person in the right department. This process can take a couple of days and then the person will search through the existing solutions and address the problem which would again take several more hours. This whole thing slows down the response cycle to the customer.
   - Bug triaging and escalation using machine learning is being used. This is a very useful method. In this technique basically, an automated system processes the incoming bug report, identifies the top 5 people suited to resolve the issue. It also searches through the knowledge database and finds the best fits. These recommendations are sent to Bug Triaging system where feedback is recorded and the prediction also gets better with time.
   - This results in huge savings in time and can save millions of dollars for the company and drive customer satisfaction.

4. NLP based specs where machine learning is used to reduce manual costs to create assertions, reduce errors and bring incomprehensibility and linking to plans.

5. Optimizing Grid Efficiency for regressions where ML helps to improve farm utilization, improve TAT for regression runs and reduce IT costs.

6. Test Management and Mining with Big Data is another application where machine learning is being used to improve the release quality, identify the right tests to run, data mining for increased support and helping to find the tests that match customer environment.

Other uses of machine learning in verification systems include reducing support costs, Assess code risk analysis, failure triaging.