**Problem Statement/Introduction**

- Verification engineers taking more time in coverage closure.
- Random nature of test sequences never guarantee 100% coverage in every regression.
- Significant increase in resource usage (servers, simulation tool licenses, manual effort and time)
- Verification Engineer’s skillset has a dependency on the regression efficiency.
- Currently no automation to increase the regression efficiency and achieve coverage closure faster.

**Proposed Methodology/Advantages**

This paper introduces a methodology using machine learning with metric driven verification using logic simulation (ML-MDVLS), which achieves regression efficiency in a structured way. It uses machine learning to analyse randomly generated test data and also how that data correlates to the coverage goals. Then, ML-MDVLS creates a new highly optimized regression set with special simulator instructions to achieve the desired coverage more efficiently.

Machine Learning (ML) technology and core computational software when integrated into simulation engines, enable orders of magnitude (up to 3X) faster verification closure schedule of the randomized regressions run. Experiments on live projects at Samsung show 3-4X overall regression size optimization, which translates to saving at least 3-5 person-days of effort per regression run for that IP block. Machine learning provides a great deal of potential for finding patterns in verification environments which correlate to coverage goals, and thereby can effectively be used to vastly improve verification efficiency and coverage closure.

**Implementation Diagrams**

Learning Model building, Generating ML based Optimized regressions, Analytics cmds

![Implementation Diagrams](Image)

**Results Table**

Optimized results of modem IP after using the ML-MDVLS methodology on a randomized set of regressions.

![Results Table](Image)

Optimized results of multimedia IP after using the ML-MDVLS methodology. Here the input regressions were ranked regressions.

![Results Table](Image)

**Conclusion**

The experiments on live IP projects at Samsung showed 3-4X overall regression optimization which translates to saving at least 3-5 person-days of effort per regression run for the Modem IP which originally had a fully random regression. In case of the Multimedia IP which originally had a ranked regression, 1.7X3 overall regression optimization was observed. Earlier verification signoff of these IPs using the ML-MDVLS methodology enabled faster hand-off to downstream teams thereby shortening the whole IP design cycle - the productivity improvement was tremendous.