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Exploring Machine Learning to assign debug priorities to improve the design quality

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Motivation

- Hardware Designs continue to grow in size and complexity
- Increasing complexity of designs amplifies the chances of finding more design bugs
- Discovering design bugs after the product release may lead to expensive outcomes
- Hardware verification has become increasing challenging consuming more than 50% of the design effort





Motivation

• More than 30% effort put in Bucketizing regression failures.





- Proposed exploratory work addresses
 - Prioritization of regression failures in verification using ML and subsequent debug automation



Problem formulation



- Simulation log contains useful information like the error message
- Learning from past failures which have been root caused to a design or non-design bug
- Text classification problem with two classes (design and non-design)





Machine Learning and debug automation flow









Experimental results



Confusion matrix for AdaBoostClassifier



 AdaBoostClassifier is best with design recall of 0.82 and non-design recall of 0.50





Conclusion

- Good application of ML for debug prioritization
- Proper data collection and extensive wrangling are main challenges to be solved
- ML model performance can be improved further using better data cleaning, tuning etc.
- Can extend this work to solve other related problems in hardware validation





Questions





BACKUP





Machine Learning model exploration and integration





ML model exploration

ML Model	Best non-design recall
LogisticRegression	0.52
LinearSVC	0.53
DecisionTreeClassifier	0.53
RandomForestClassifier	0.28
AdaBoostClassifier	0.50



Best ML model hyperparameters and performance

Metric	Value(s)
Optimal hyperparameters for AdaBoostClassifier	base_estimator=DecisionTreeClassifier(max_depth=1,
	min_samples_leaf=2, min_samples_split=6),
	n_estimators=80, learning_rate=0.3, algorithm='SAMME.R'
Precision for design class	0.59
Recall for design class (most relevant metric for	0.82
the problem)	
Precision for non-design class	0.76
Recall for non-design class	0.50





Cloud database snapshot

🔊 MySQL Workbench

error_db - Warning - not supp... 🗙

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