Grade-level classification of oral squamous cell carcinoma (OSCC) from digital pathology using ensemble deep learning algorithms.

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A PROBLEM STATEMENT

Automated diagnosis of Oral Cancer from Histopathology Images (H&E) both at the stage level and grade level.

B THE DATA

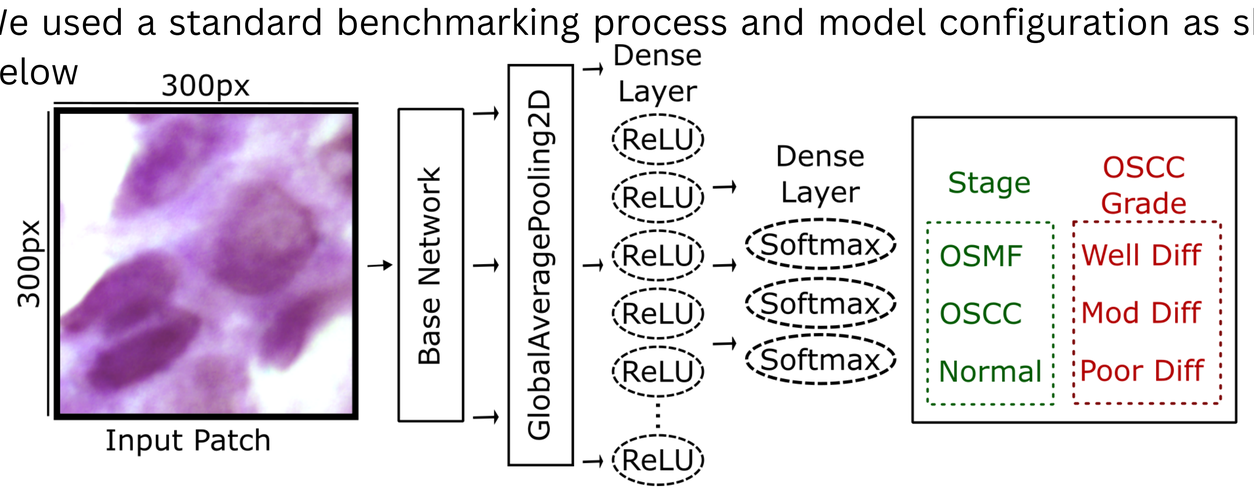
Sourced from 5 Hospitals across northern India: Jamia Millia Islamia, New Delhi; Maulana Azad Institute of Dental Sciences; All India Institute of Medical Sciences; Rajendra Prasad Institute of Medical Sciences; and Banaras Hindu University.

Training set		# tissue slides		# patches (300x300)	
Normal		8		80568	
OSMF		25		183158	
OSCC	WD	62	26	422293	124526
	MD		21		144887
	PD		15		152880

WD=Well Differentiated, MD=Moderately Differentiated PD=Poorly Differentiated,

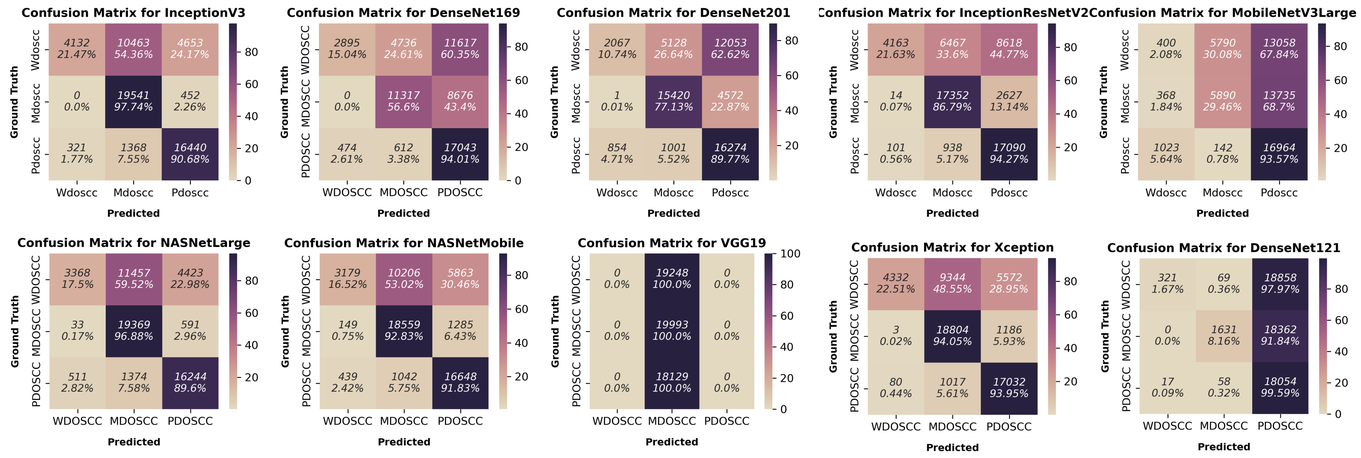
C BENCHMARKING PROCESS

- Benchmarked 10 models each for the classification of the subtypes as well as the grades.
- We used a standard benchmarking process and model configuration as shown below

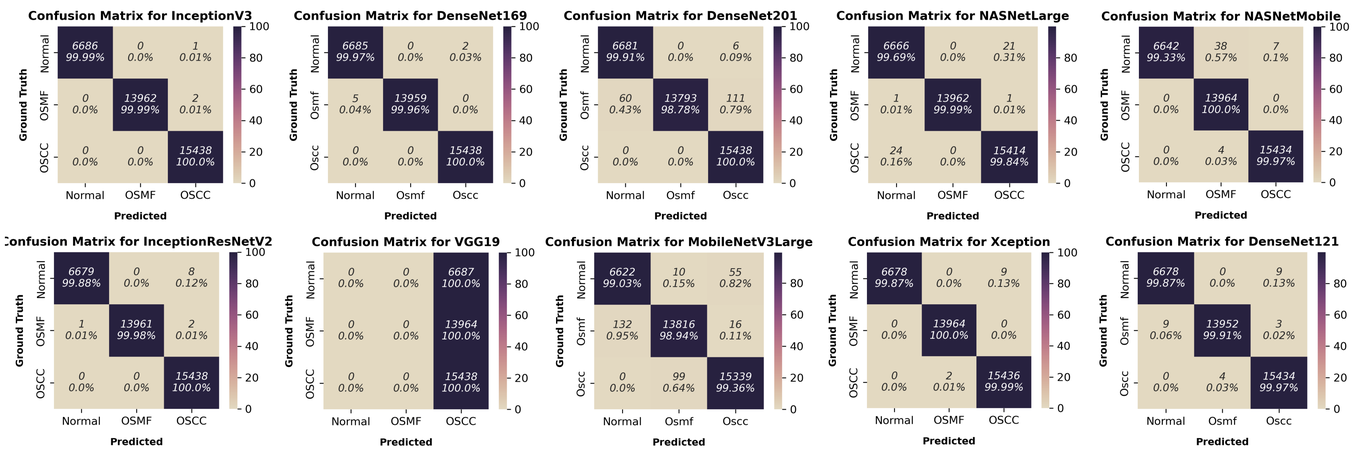


D BENCHMARKING RESULTS

Classification of WDOSCC, MDOSCC, and PDOSCC



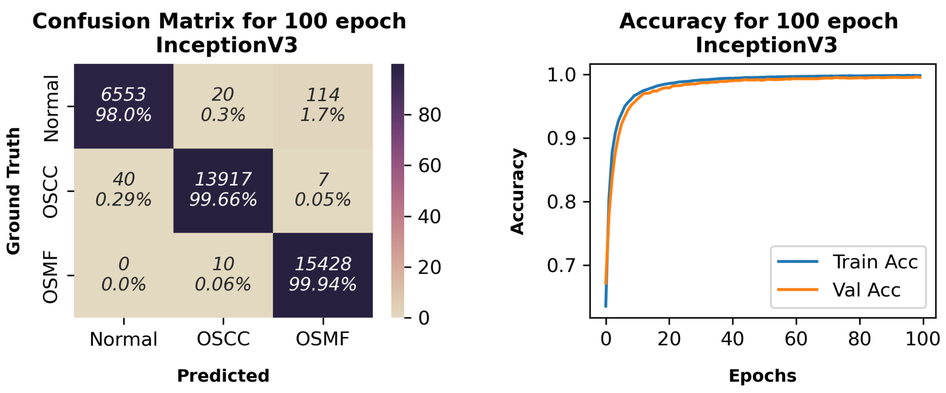
Classification of Normal, OSMF, and OSCC



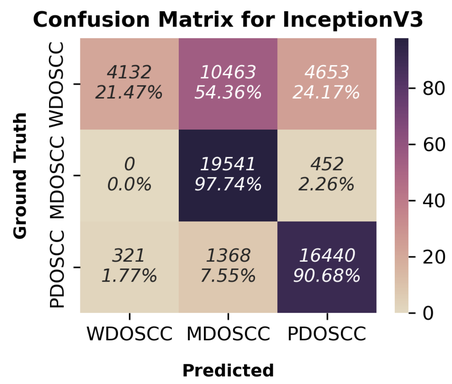
E BEST PERFORMERS

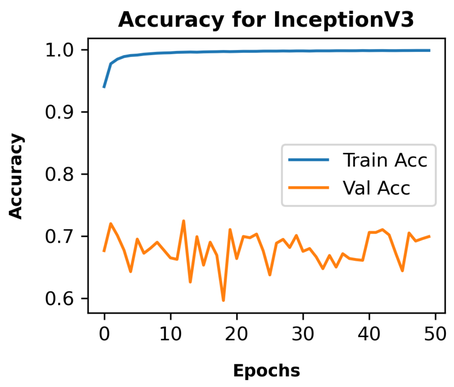
InceptionV3 showed best performance in both cases with high accuracy and low loss in the internal validation stage, as shown below.

Classification of Normal, OSMF, and OSCC



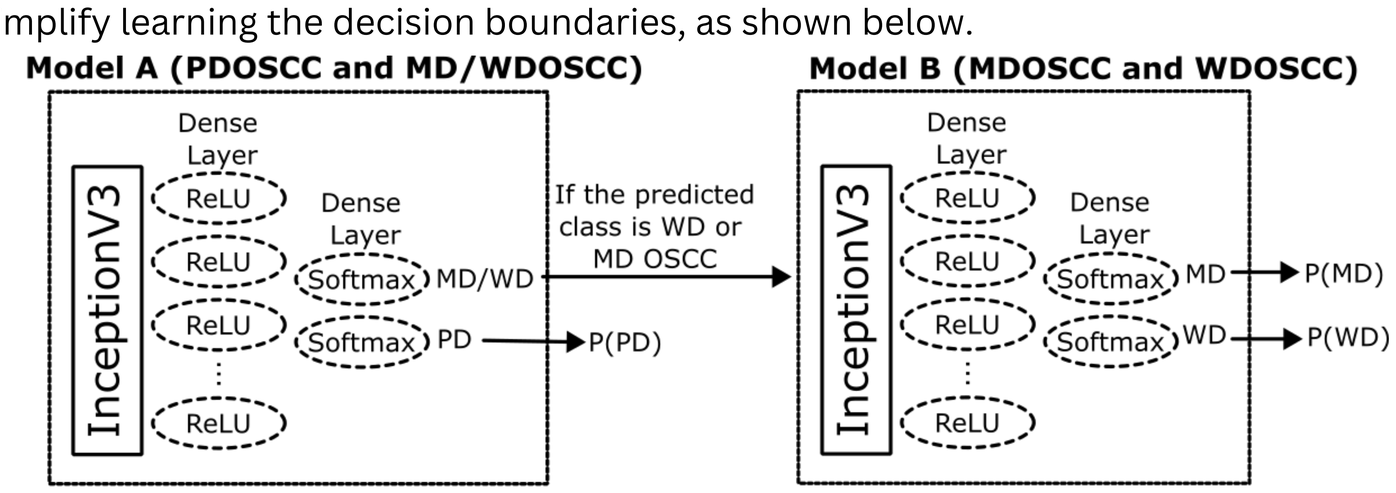
Classification of WDOSCC, PDOSCC, and MDOSCC





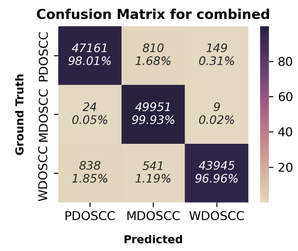
F ENSEMBLE WORKDLOW FOR OSCC GRADE CLASSIFICATION

Built upon the foundation of the InceptionV3 architecture due to benchmarking performance.The classification step is divided and split between two models to simplify learning the decision boundaries, as shown below.



G ENSEMBLE PERFORMANCE

- The ensemble was able to achieve 95%+ accuracy on the final three class classification problem on the internal validation dataset.
- **FUTURE DIRECTION:** We would want to further fine-tune the sub-models of the ensemble with modifications to the architecture to ensure avoidance of over/under-fitting. We would also like to carry out external validation on independent cohorts of data.



REFERENCES & INFO

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