

# Classification of Epithelial Ovarian Carcinoma Whole-Slide Pathology Images Using Deep Transfer Learning

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THE UNIVERSITY  
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**OV CARE**  
BC'S GYNECOLOGIC CANCER RESEARCH TEAM

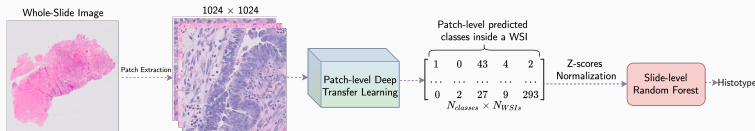


**PATHOLOGY**  
laboratory medicine

**Vancouver  
Coastal Health  
Research Institute**

- There are 5 major histological subtypes of epithelial ovarian cancer: HGSOC, CCOC, ENOC, LGSOC and MUC.
- These five major histotypes have distinct morphological, molecular, genetic, and clinical features.
- Problem: without gynecologic pathology-specific training, which reflects most current pathology practices, inter-observer agreement in diagnosing these histotypes is moderate, with Cohen's kappa varying between 0.54 and 0.67.
- Clinical need: methods to improve ovarian cancer histotype classification based on pathology slide images are needed.

- 305 whole slide images (WSI) composed of 157 HGSOE, 53 CCOC, 55 ENOC, 29 LGSOE, and 11 MUC were collected from the Vancouver General Hospital.
- The histological subtypes were determined by molecular assays and reviewed by several pathologists.
- Representative areas of tumor in each WSI were annotated by a board-certified pathologist.



**Figure 1:** Proposed WSI classification workflow.

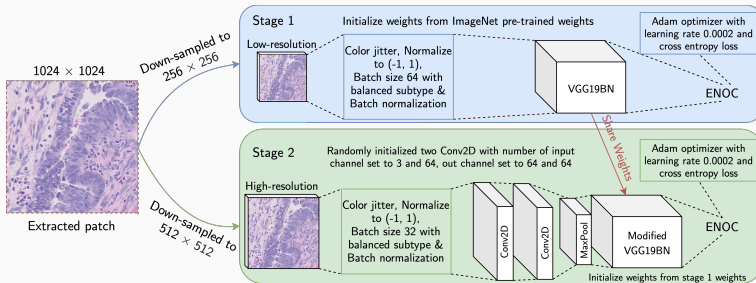


Figure 2: Proposed two-stage patch-level deep transfer learning workflow

Classifier	Mean Per-Class Accuracy					Overall			
	HGSOC	CCOC	ENOC	LGSOC	MUC	Accuracy	Kappa	AUC	F1 Score
Baseline 1 Patch-Level	67.15%	<b>90.44%</b>	62.79%	<b>71.00%</b>	55.96%	69.83%	0.5992	<b>0.9120</b>	0.6850
Baseline 2 Patch-Level	62.76%	81.10%	59.51%	52.34%	53.31%	62.63%	0.5024	0.8410	0.6184
Stage 1 Patch-Level	<b>74.94%</b>	84.04%	<b>67.89%</b>	61.81%	59.98%	<b>71.75%</b>	<b>0.6187</b>	0.9035	0.6984
Stage 2 Patch-Level	71.67%	88.77%	62.68%	68.41%	<b>60.71%</b>	71.60%	0.6179	0.8890	<b>0.7047</b>
Baseline 1 Slide-Level	80.25%	83.02%	54.55%	65.52%	54.55%	73.77%	0.5993	0.9391	0.6855
Baseline 2 Slide-Level	80.13%	75.47%	34.55%	68.97%	54.55%	69.08%	0.5224	0.8481	0.6479
Stage 1 Slide-Level	85.99%	79.25%	61.82%	79.31%	54.55%	78.69%	0.6730	0.9375	0.7414
Stage 2 Slide-Level	<b>90.45%</b>	<b>86.79%</b>	<b>74.55%</b>	<b>100.0%</b>	<b>81.82%</b>	<b>87.54%</b>	<b>0.8106</b>	<b>0.9641</b>	<b>0.8718</b>

**Table 1:** Patch- and slide-level performance measured by various metrics in cross-validation.