Supplemental Document

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The following table 1-4 show the 9-fold cross validation results using models including: Resnet34, PT MobileNetv2, ResNet50 and PT Resnet50, respectively.

Table 1. Training results of the 9-fold cross validation using ResNet34

Testing folds	k1_val	k2_val	k3_val	k4_val	k5_val	k6_val	k7_val	k8_val	k9_val	k10_val	average	std error
K1		77.0%	84.6%	96.1%	98.1%	86.8%	64.5%	76.4%	97.6%	73.4%	**83.8%**	**3.7%**
K2	85.8%		79.7%	96.1%	94.3%	79.7%	74.4%	80.0%	96.9%	74.7%	**84.6%**	**2.8%**
K3	95.4%	81.6%		91.8%	95.7%	88.6%	71.0%	72.9%	94.5%	68.9%	**84.5%**	**3.5%**
K4	82.4%	89.1%	76.5%		92.3%	86.3%	72.7%	82.7%	96.4%	73.1%	**83.5%**	**2.6%**
K5	82.4%	93.3%	87.2%	93.0%		89.0%	75.6%	58.9%	99.0%	67.0%	**82.8%**	**4.2%**
K6	84.2%	93.3%	73.5%	92.1%	99.3%		72.2%	73.5%	97.8%	74.4%	**84.5%**	**3.6%**
K7	84.7%	91.2%	68.8%	97.1%	83.2%	79.3%		80.2%	91.2%	69.8%	**82.8%**	**3.0%**
K8	90.0%	88.4%	81.3%	97.2%	97.3%	65.0%	83.6%		70.0%	66.2%	**82.1%**	**3.9%**
K9	72.2%	90.5%	70.0%	95.4%	96.8%	88.5%	76.0%	62.6%		62.2%	**79.4%**	**4.3%**
K10	85.0%	91.2%	79.1%	97.5%	93.1%	90.0%	69.8%	80.1%	91.5%		**86.4%**	**2.7%**
Average	**84.7%**	**88.4%**	**77.9%**	**95.2%**	**94.5%**	**83.7%**	**73.3%**	**74.1%**	**92.8%**	**70.0%**		

Table 2. Training results of the 9-fold cross validation using PT MobileNetv2

Testing folds	k1_val	k2_val	k3_val	k4_val	k5_val	k6_val	k7_val	k8_val	k9_val	k10_val	average	std error
K1		88.0%	90.7%	97.9%	95.4%	71.1%	69.5%	85.0%	86.3%	73.5%	**84.1%**	**3.5%**
K2	86.8%		79.9%	88.8%	99.5%	79.3%	65.5%	81.4%	93.4%	64.5%	**82.1%**	**3.9%**
K3	93.3%	96.2%		89.1%	96.1%	75.9%	65.8%	71.7%	96.3%	70.7%	**83.9%**	**4.2%**
K4	85.6%	93.8%	35.6%		92.0%	77.3%	65.7%	85.7%	94.9%	71.3%	**78.0%**	**6.3%**
K5	87.8%	91.7%	69.0%	91.6%		79.0%	83.7%	78.8%	77.0%	91.6%	**83.3%**	**2.7%**
K6	81.5%	90.1%	75.5%	89.7%	98.8%		77.0%	80.1%	93.9%	88.9%	**86.2%**	**2.7%**
K7	88.4%	90.4%	59.6%	97.1%	97.7%	88.4%		84.8%	79.0%	88.9%	**86.0%**	**3.8%**
K8	84.1%	90.4%	74.2%	97.9%	94.4%	71.4%	54.2%		44.2%	74.3%	**76.1%**	**6.0%**
K9	87.4%	92.4%	64.7%	94.9%	94.3%	69.9%	73.9%	59.4%		62.7%	**77.7%**	**4.8%**
K10	87.6%	90.9%	56.6%	96.3%	95.6%	77.0%	68.0%	73.9%	90.2%		**81.8%**	**4.6%**
Average	**87.0%**	**91.5%**	**67.3%**	**93.7%**	**96.0%**	**76.6%**	**69.2%**	**77.9%**	**83.9%**	**76.2%**		

Table 3. Training results of the 9-fold cross validation using ResNet50

Testing folds	k1_val	k2_val	k3_val	k4_val	k5_val	k6_val	k7_val	k8_val	k9_val	k10_val	average	std error
K1		87.5%	77.9%	95.6%	95.1%	81.9%	72.4%	90.0%	98.0%	85.4%	**87.1%**	**2.9%**
K2	89.8%		84.6%	97.7%	96.2%	75.1%	78.4%	79.4%	98.6%	82.7%	**87.0%**	**3.0%**
K3	87.9%	88.4%		95.8%	95.9%	85.4%	73.1%	85.4%	95.4%	89.0%	**88.5%**	**2.4%**
K4	86.2%	86.2%	77.7%		90.7%	76.3%	79.5%	90.5%	98.0%	80.2%	**85.0%**	**2.4%**
K5	81.9%	86.9%	81.6%	93.2%		88.7%	81.8%	86.0%	95.9%	94.2%	**87.8%**	**1.9%**
K6	88.5%	87.4%	83.5%	93.5%	97.9%		82.4%	86.3%	96.7%	79.4%	**88.4%**	**2.1%**
K7	86.0%	86.1%	87.9%	97.9%	94.2%	86.2%		86.4%	91.9%	80.8%	**88.6%**	**1.7%**
K8	89.3%	88.8%	78.8%	96.4%	94.9%	75.2%	79.9%		95.7%	90.4%	**87.7%**	**2.6%**
K9	81.8%	87.0%	83.9%	96.5%	96.9%	75.3%	65.7%	81.8%		70.2%	**82.1%**	**3.6%**
K10	88.5%	91.1%	81.8%	96.4%	96.5%	86.2%	65.5%	87.9%	93.3%		**87.5%**	**3.2%**
Average	**86.7%**	**87.7%**	**82.0%**	**95.9%**	**95.4%**	**81.1%**	**75.4%**	**86.0%**	**95.9%**	**83.6%**		

Table 4. Training results of the 9-fold cross validation using PT ResNet50

Testing folds	k1_val	k2_val	k3_val	k4_val	k5_val	k6_val	k7_val	k8_val	k9_val	k10_val	average	std error
K1		89.4%	89.4%	94.5%	93.6%	78.5%	84.1%	85.2%	93.0%	94.6%	**89.2%**	**2.4%**
K2	86.8%		84.2%	94.1%	99.7%	90.5%	91.4%	73.3%	99.1%	88.9%	**89.8%**	**2.4%**
K3	85.0%	86.5%		92.5%	97.1%	93.1%	88.3%	81.4%	91.6%	63.7%	**86.6%**	**2.4%**
K4	88.3%	90.6%	83.9%		95.4%	87.6%	90.5%	80.6%	96.7%	76.4%	**87.8%**	**2.3%**
K5	88.1%	84.8%	81.3%	93.1%		89.1%	94.5%	80.6%	95.5%	82.2%	**87.7%**	**2.3%**
K6	89.0%	89.6%	85.4%	96.1%	98.1%		86.6%	77.6%	95.8%	74.8%	**88.1%**	**2.4%**
K7	85.0%	89.3%	81.2%	93.6%	96.4%	89.2%		83.5%	77.2%	83.8%	**86.6%**	**2.8%**
K8	89.4%	80.0%	74.1%	95.1%	97.6%	89.7%	75.9%		97.1%	93.0%	**88.0%**	**2.9%**
K9	85.1%	89.7%	73.4%	89.7%	97.8%	84.0%	92.8%	76.8%		76.7%	**85.1%**	**3.0%**
K10	89.3%	92.1%	78.5%	96.2%	98.0%	80.9%	87.1%	78.8%	88.8%		**87.7%**	**3.3%**
Average	**87.3%**	**88.0%**	**81.3%**	**93.9%**	**97.1%**	**86.9%**	**87.9%**	**79.8%**	**92.8%**	**81.6%**		

The following tables show the confusion matrix for each of the 10 kidneys in the10-fold cross-testing.

Kidney 1		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	990	10	0	1000
	Cortex	703	297	0	1000

	Calyx	26	0	974	1000
Total		1719	307	974	

Kidney 2		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	713	262	25	1000
	Cortex	2	990	8	1000
	Calyx	0	67	933	1000
Total		715	1319	966	

Kidney 3		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	750	250	0	1000
	Cortex	593	407	0	1000
	Calyx	0	16	984	1000
Total		1343	673	984	

Kidney 4		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	988	12	0	1000
	Cortex	126	870	4	1000
	Calyx	15	79	906	1000
Total		1129	961	910	

Kidney 5		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	998	2	0	1000
	Cortex	26	953	21	1000
	Calyx	0	155	845	1000
Total		1024	1110	866	

Kidney 6		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	989	11	0	1000
	Cortex	0	57	943	1000
	Calyx	0	16	984	1000
Total		989	84	1927	

Kidney 7		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	943	57	0	1000
	Cortex	3	848	149	1000

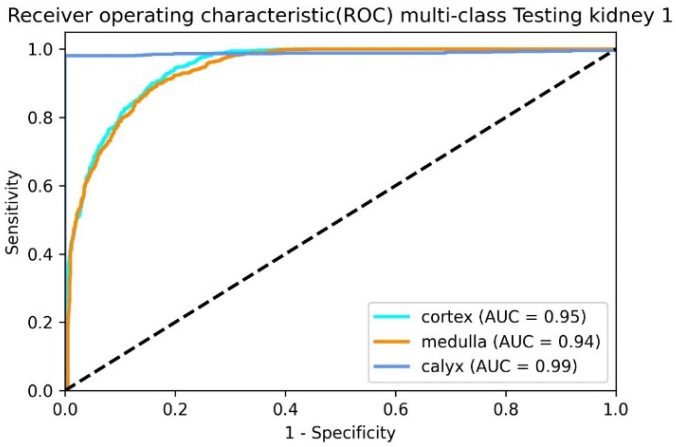
	Calyx	0	286	714	1000
Total		946	1191	863	

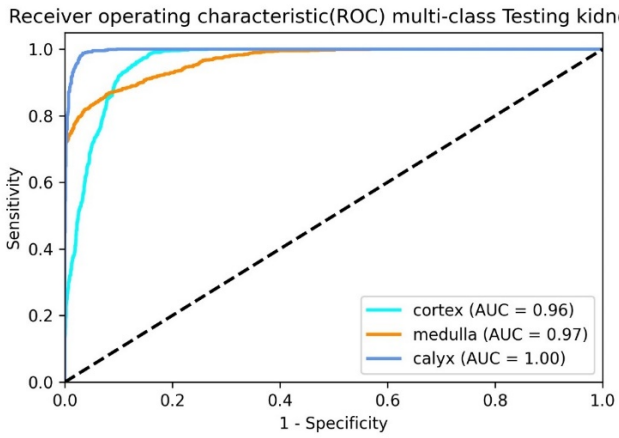
Kidney 8		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	707	144	149	1000
	Cortex	2	940	58	1000
	Calyx	0	1	999	1000
Total		709	1085	1206	

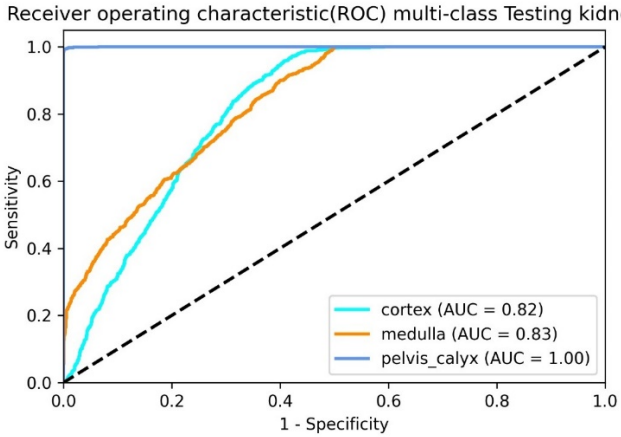
Kidney 9		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	1000	0	0	1000
	Cortex	7	993	0	1000
	Calyx	94	132	774	1000
Total		1101	1125	774	

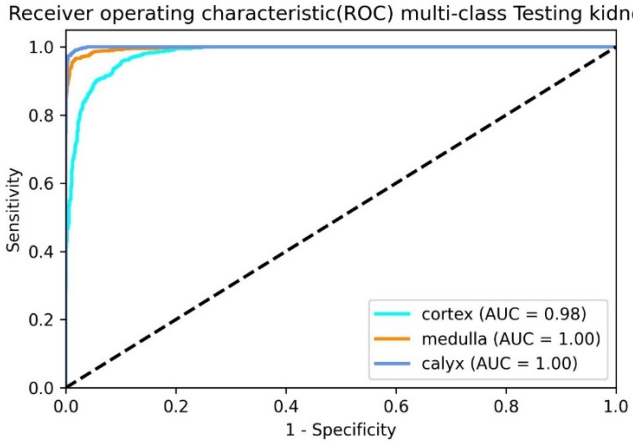
Kidney 10		Predicted			Total
		Medulla	Cortex	Calyx	
True	Medulla	1000	0	0	1000
	Cortex	580	419	1	1000
	Calyx	1	194	805	1000
Total		1581	613	806	

The following plots show the ROC curve of each of the 10 kidneys in the 10-fold cross-testing.

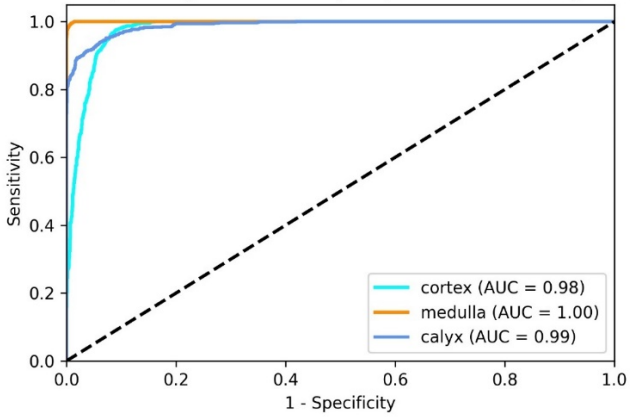



Receiver operating characteristic(ROC) multi-class Testing kidney 2
Sensitivity
1 - Specificity
cortex (AUC = 0.96)
medulla (AUC = 0.97)
calyx (AUC = 1.00)

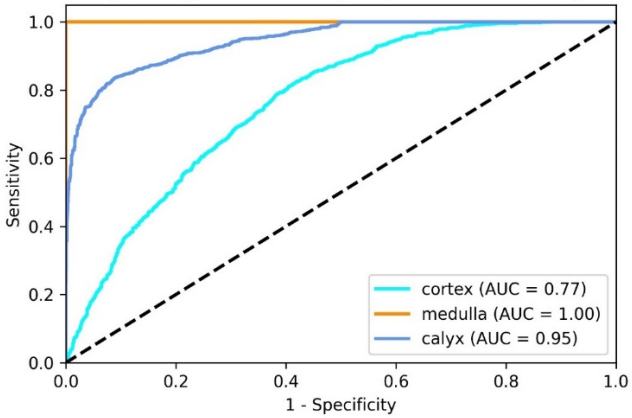

Receiver operating characteristic(ROC) multi-class Testing kidney 3
Sensitivity
1 - Specificity
cortex (AUC = 0.82)
medulla (AUC = 0.83)
pelvis_calyx (AUC = 1.00)


Receiver operating characteristic(ROC) multi-class Testing kidney 4
Sensitivity
1 - Specificity
cortex (AUC = 0.98)
medulla (AUC = 1.00)
calyx (AUC = 1.00)

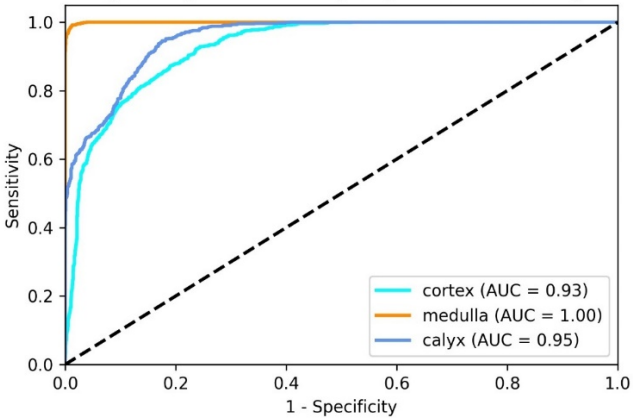
Receiver operating characteristic(ROC) multi-class Testing kidney 5

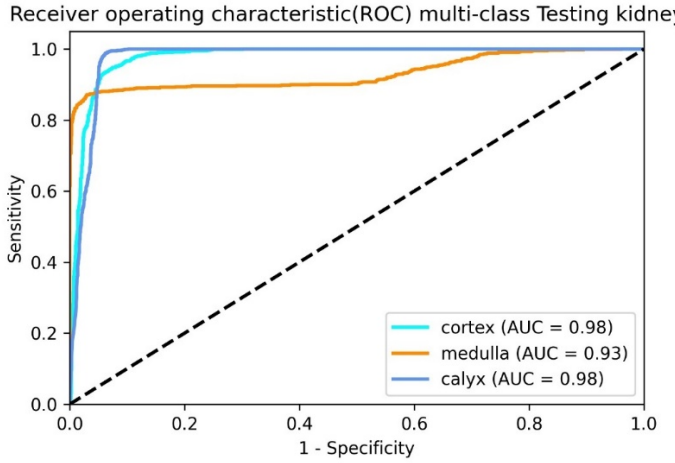


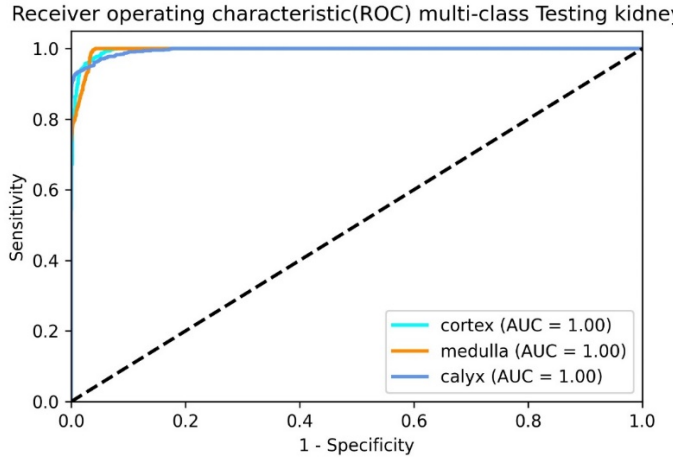
Receiver operating characteristic(ROC) multi-class Testing kidney 6

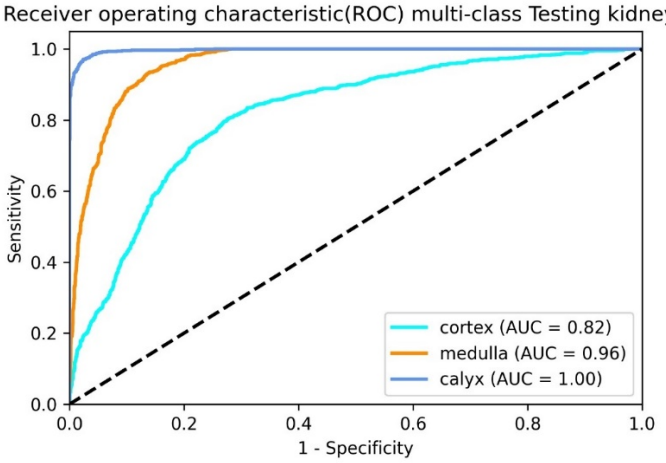


Receiver operating characteristic(ROC) multi-class Testing kidney 7




Receiver operating characteristic(ROC) multi-class Testing kidney 8
Sensitivity
1 - Specificity
0.0
0.2
0.4
0.6
0.8
1.0
cortex (AUC = 0.98)
medulla (AUC = 0.93)
calyx (AUC = 0.98)


Receiver operating characteristic(ROC) multi-class Testing kidney 9
Sensitivity
1 - Specificity
0.0
0.2
0.4
0.6
0.8
1.0
cortex (AUC = 1.00)
medulla (AUC = 1.00)
calyx (AUC = 1.00)


Receiver operating characteristic(ROC) multi-class Testing kidney 10
Sensitivity
1 - Specificity
0.0
0.2
0.4
0.6
0.8
1.0
cortex (AUC = 0.82)
medulla (AUC = 0.96)
calyx (AUC = 1.00)