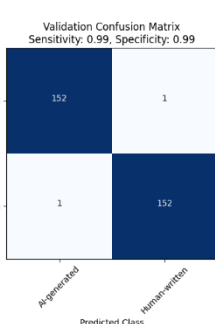
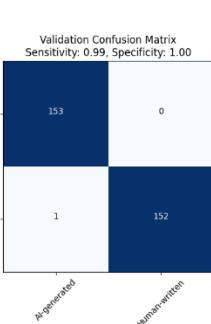
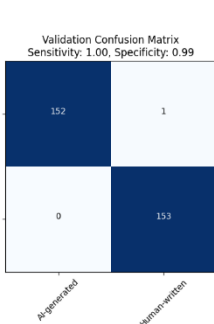

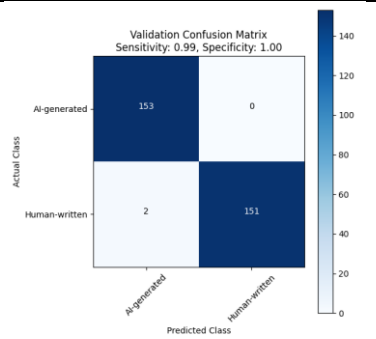


Results narrative:

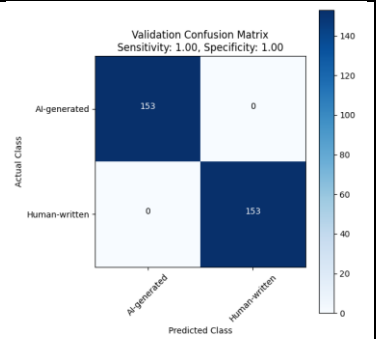
The following are the experiments running results in detail. For those interested in a deeper exploration of the data, the trained model weights derived from these experiments are available for download. These resources can be accessed via our dedicated GitHub repository at the following URL:

[https://github.com/Hamed1Hamed/Arabic\\_AI\\_Detector/tree/main/Results](https://github.com/Hamed1Hamed/Arabic_AI_Detector/tree/main/Results).

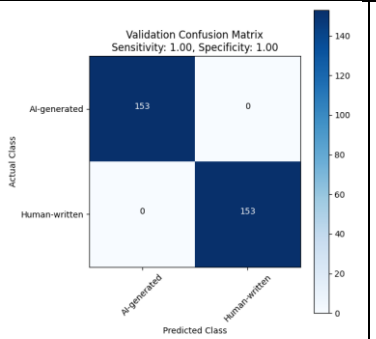
AraELECTRA-base-discriminator Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
	1	Custom dataset			First Run on Dataset	We ran for 10 epochs. With enhancements on the learning rate by applying warmup phase. "learning_rate": 3.2e-05, "initial_learning_rate": 5e-6, Linear increase from initial to LR. Then applying cosine_annealing, where it smoothly decreases the learning rate according to a cosine function.
	Confusion Matrix on Validation Set					
	<div><div><div>Validation Confusion Matrix Sensitivity: 0.99, Specificity: 0.99</div></div><div>Epoch 1</div></div>					
	<div><div><div>Validation Confusion Matrix Sensitivity: 0.99, Specificity: 1.00</div></div><div>Epoch 2</div></div>					
	<div><div><div>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 0.99</div></div><div>Epoch 3</div></div>					
	<div><div><div>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 0.99</div></div><div>Epoch 4</div></div>					



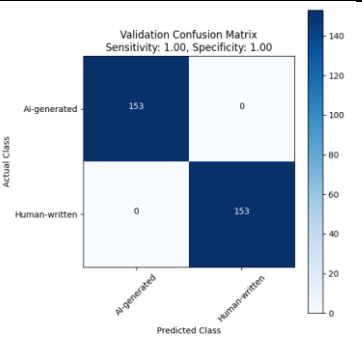
Epoch 5



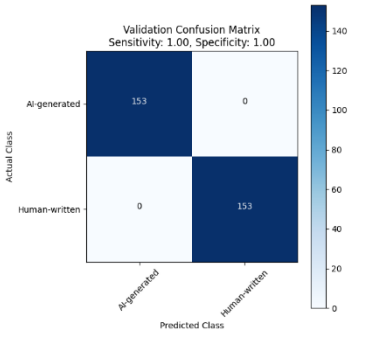
Epoch 6  
Loss: 0.0002



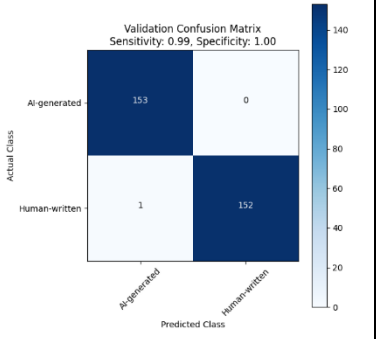
Epoch 7



Epoch 8

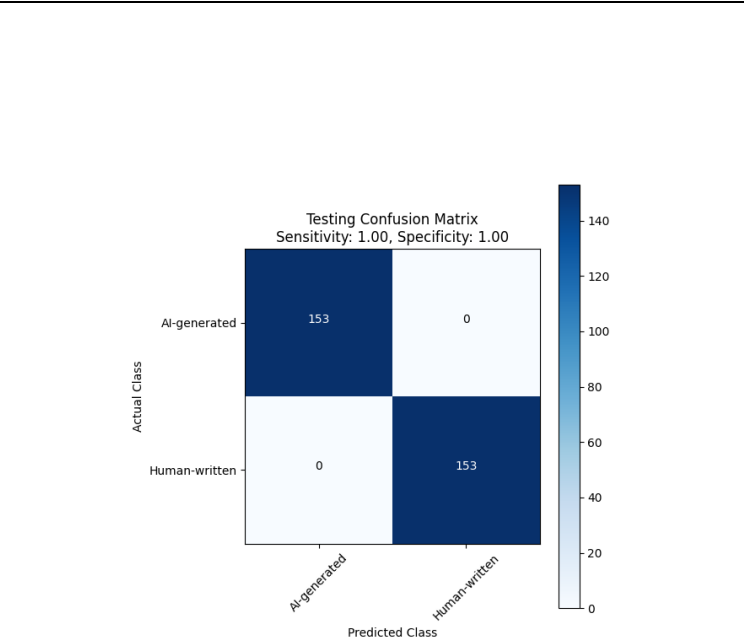


Epoch 9

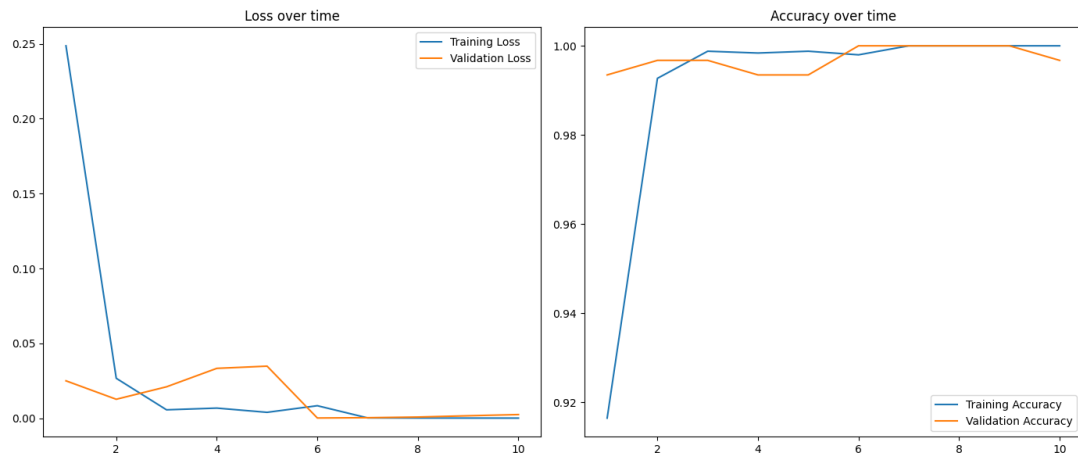


Epoch 10

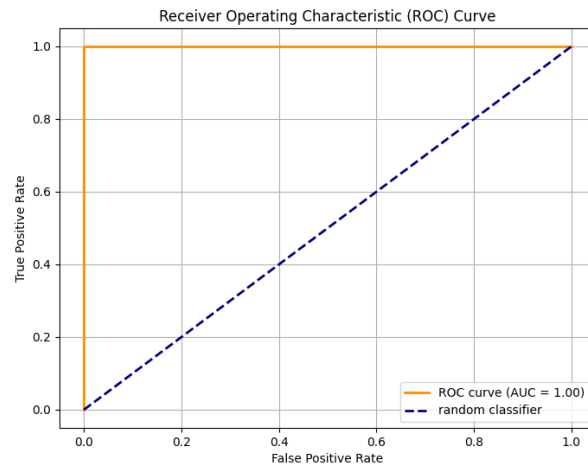
Confusion Matrix of Testing Set

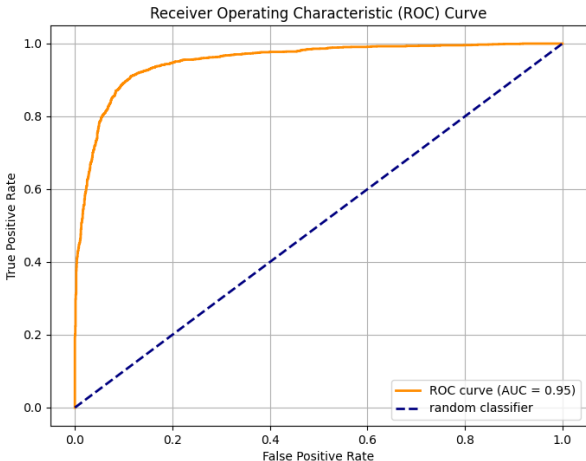
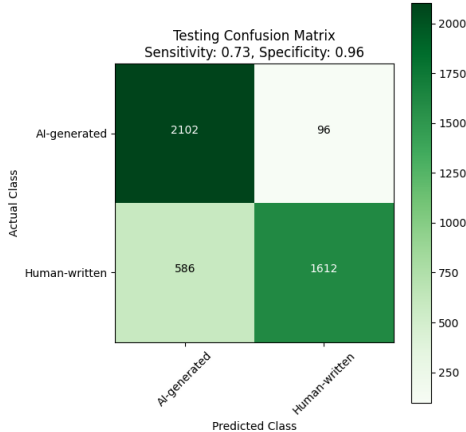


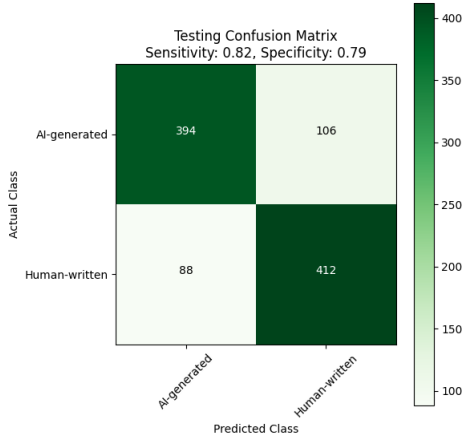
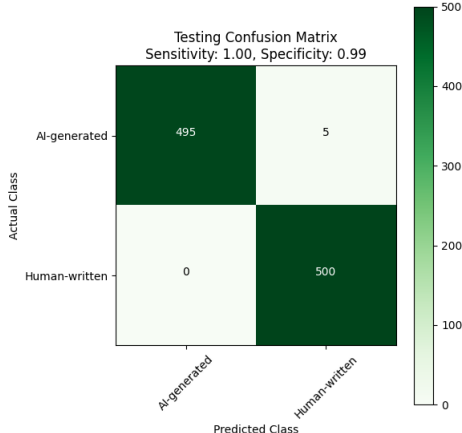
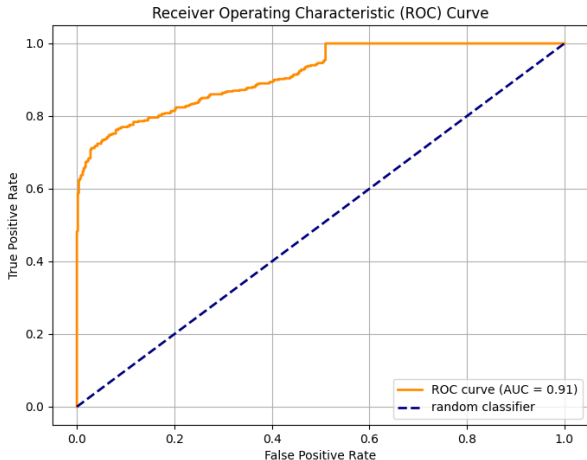
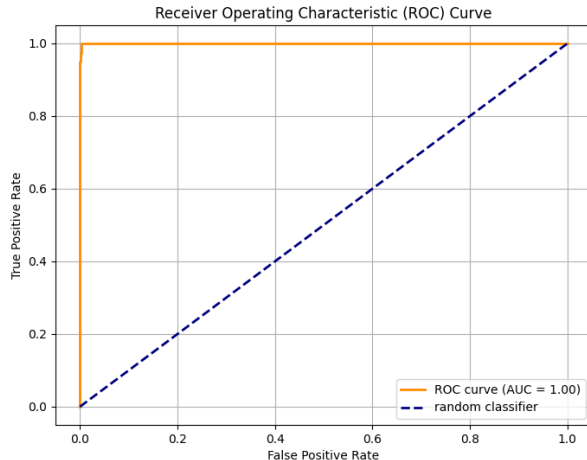
Loss and Accuracy Over Time



ROC-AUC

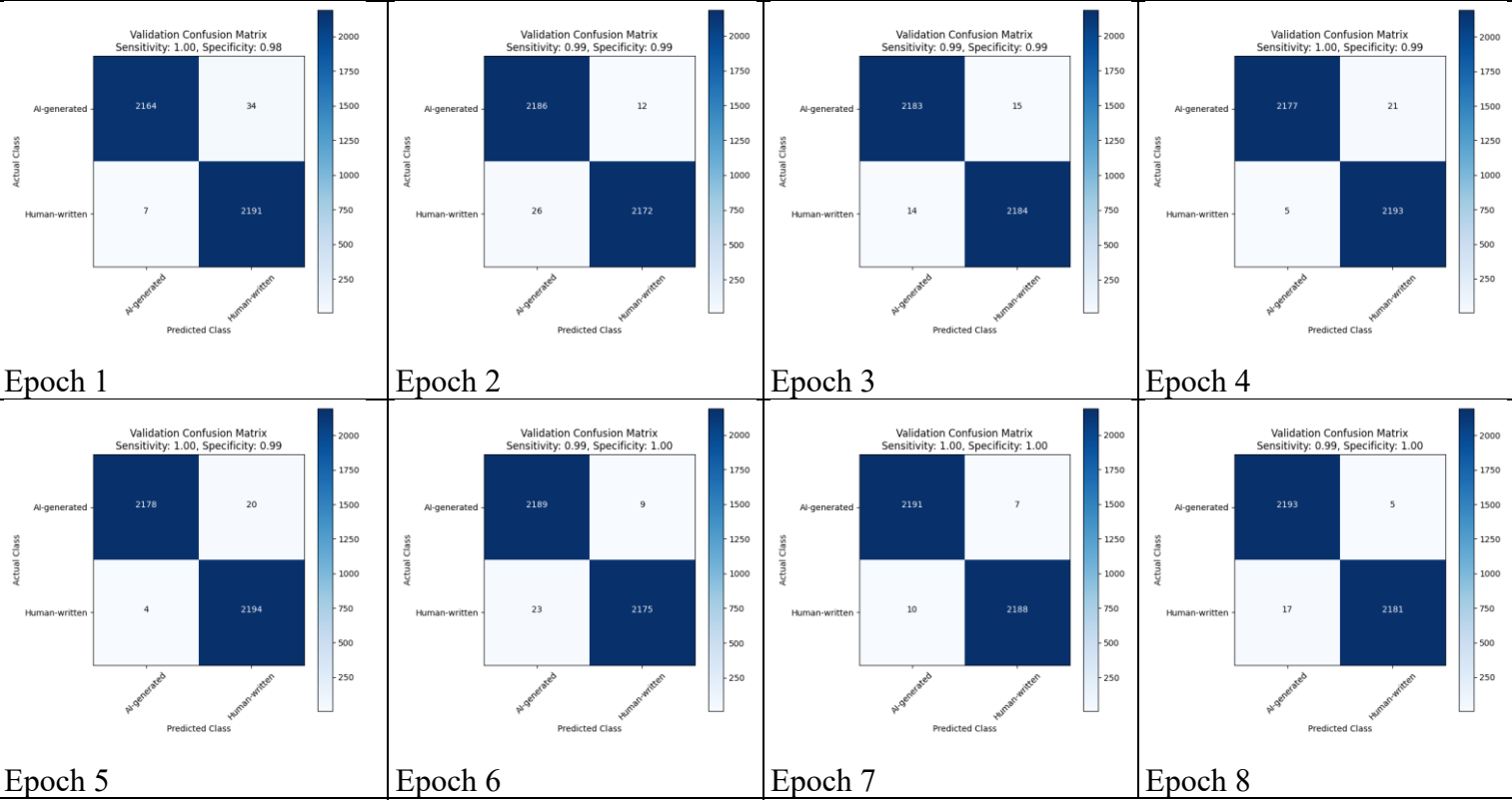


AraELECTRA-base-discriminator Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note									
	2		-	Large dataset	Using Weights from Evaluation Index [1]	No training or validation. Evaluating directly using the best weights.									
	ROC-AUC				Confusion Matrix of Testing Set										
<div>Receiver Operating Characteristic (ROC) Curve</div>  <p>ROC curve (AUC = 0.95) random classifier</p>					<div>Testing Confusion Matrix Sensitivity: 0.73, Specificity: 0.96</div>  <table><tr><th>Actual Class \ Predicted Class</th><th>AI-generated</th><th>Human-written</th></tr><tr><th>AI-generated</th><td>2102</td><td>96</td></tr><tr><th>Human-written</th><td>586</td><td>1612</td></tr></table>		Actual Class \ Predicted Class	AI-generated	Human-written	AI-generated	2102	96	Human-written	586	1612
Actual Class \ Predicted Class	AI-generated	Human-written													
AI-generated	2102	96													
Human-written	586	1612													

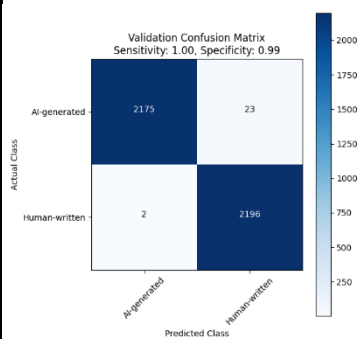
AraELECTRA-base-discriminator Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note																		
	3	-		AIRABIC	Using Weights from Evaluation Index [1]	No training or validation. Evaluating directly using the best weights.																		
	Without Dediacritization Filter Layer				With Dediacritization Filter Layer																			
	<div>Testing Confusion Matrix Sensitivity: 0.82, Specificity: 0.79</div>  <table><tr><td>Actual Class \ Predicted Class</td><td>AI-generated</td><td>Human-written</td></tr><tr><td>AI-generated</td><td>394</td><td>106</td></tr><tr><td>Human-written</td><td>88</td><td>412</td></tr></table>				Actual Class \ Predicted Class	AI-generated	Human-written	AI-generated	394	106	Human-written	88	412	<div>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 0.99</div>  <table><tr><td>Actual Class \ Predicted Class</td><td>AI-generated</td><td>Human-written</td></tr><tr><td>AI-generated</td><td>495</td><td>5</td></tr><tr><td>Human-written</td><td>0</td><td>500</td></tr></table>		Actual Class \ Predicted Class	AI-generated	Human-written	AI-generated	495	5	Human-written	0	500
	Actual Class \ Predicted Class	AI-generated	Human-written																					
AI-generated	394	106																						
Human-written	88	412																						
Actual Class \ Predicted Class	AI-generated	Human-written																						
AI-generated	495	5																						
Human-written	0	500																						
ROC-AUC				ROC-AUC																				
<div>Receiver Operating Characteristic (ROC) Curve</div>  <table><tr><td>ROC curve (AUC = 0.91)</td></tr><tr><td>random classifier</td></tr></table>				ROC curve (AUC = 0.91)	random classifier	<div>Receiver Operating Characteristic (ROC) Curve</div>  <table><tr><td>ROC curve (AUC = 1.00)</td></tr><tr><td>random classifier</td></tr></table>		ROC curve (AUC = 1.00)	random classifier															
ROC curve (AUC = 0.91)																								
random classifier																								
ROC curve (AUC = 1.00)																								
random classifier																								

Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
4	Large dataset			First Run on Dataset	We ran for 10 epochs. With enhancements on the learning rate by applying warmup phase. "learning_rate": 3.2e-5, "initial_learning_rate": 5e-6, Linear increase from initial to LR. Then, cosine_annealing is applied, which smoothly decreases the learning rate according to a cosine function.

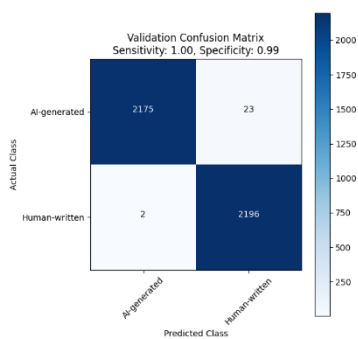
Confusion Matrix on Validation Set



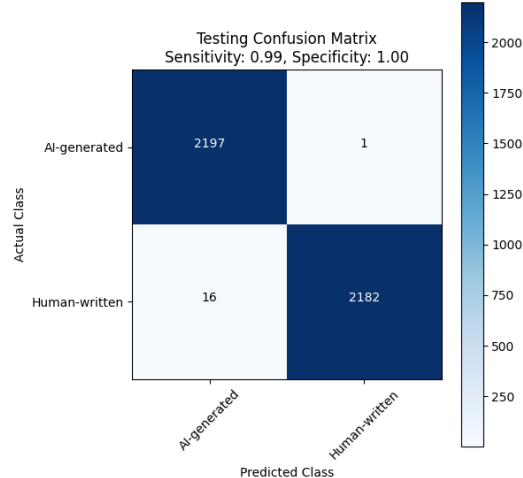
Confusion Matrix of Testing Set



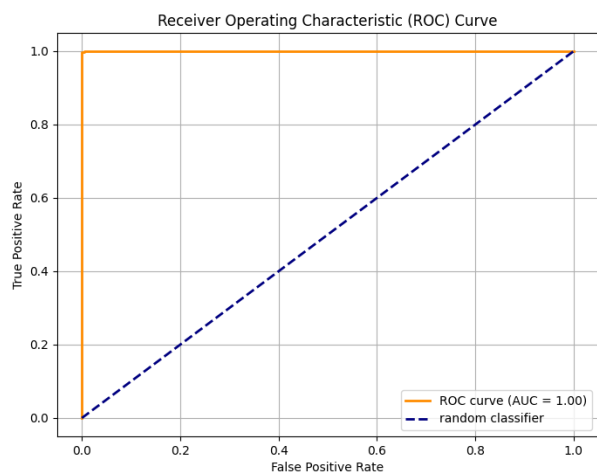
Epoch 9



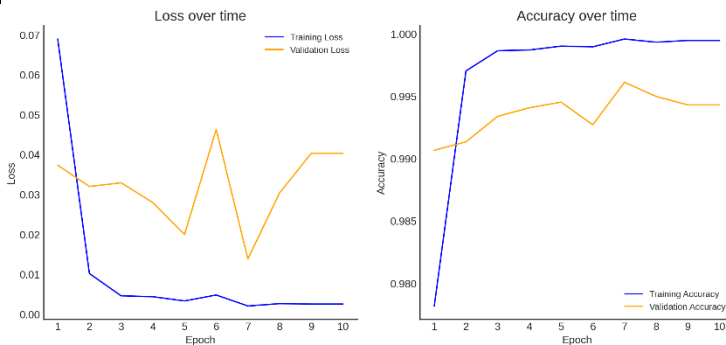
Epoch 10

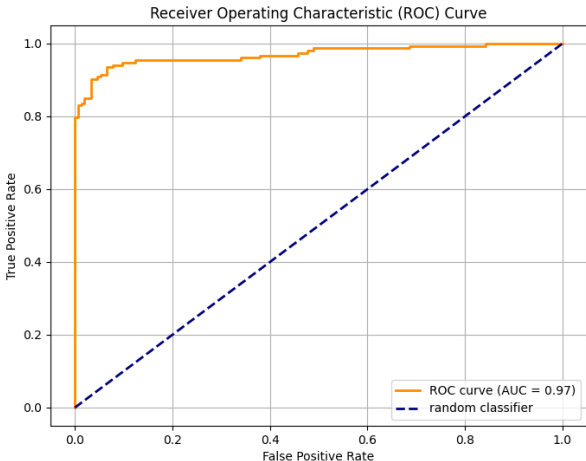
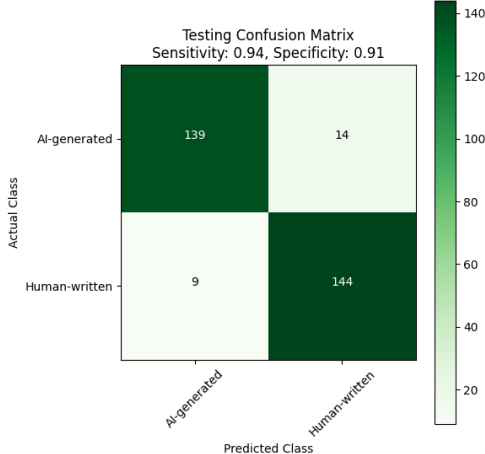


ROC-AUC

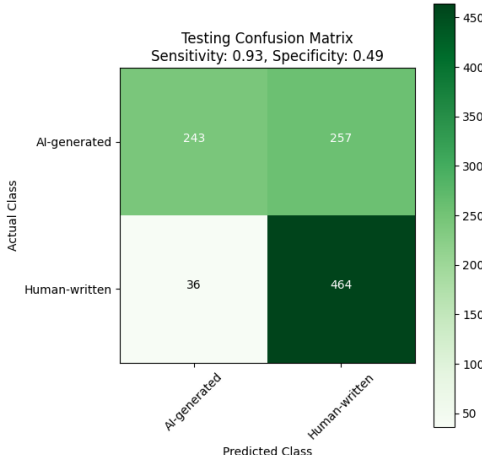
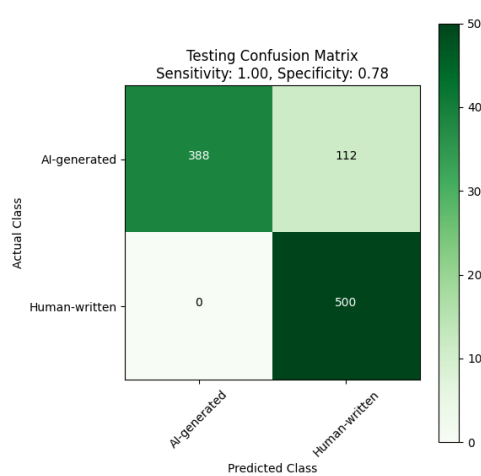
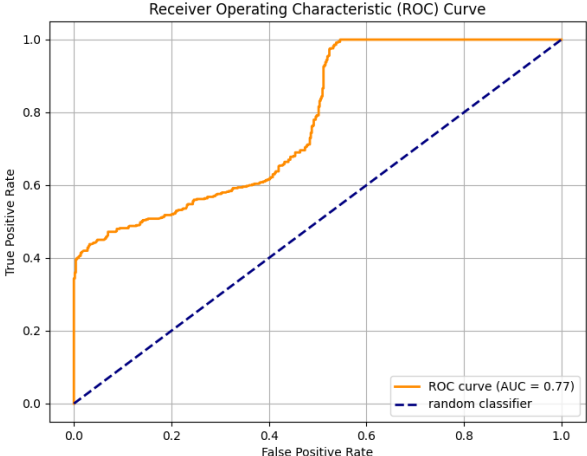
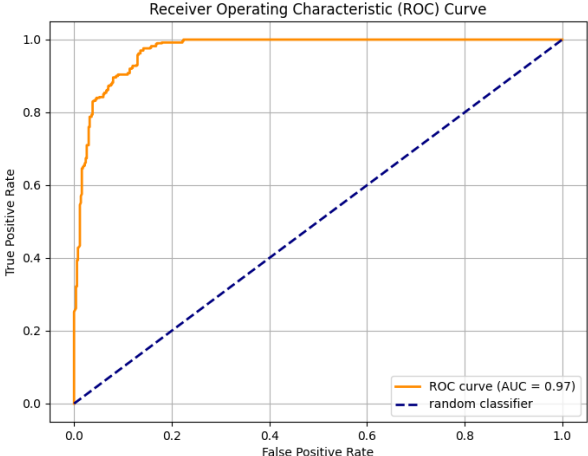


Loss and Accuracy Over Time

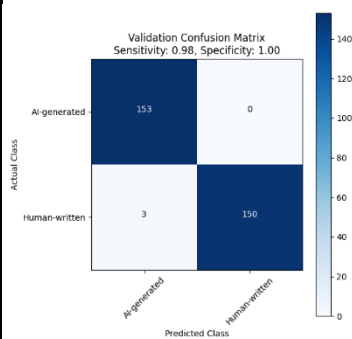


AraELECTRA-base-discriminator Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
	5		-	Custom dataset	Using Weights from Evaluation Index [4]	No training or validation. Evaluating directly using the best weights.
	ROC-AUC				Confusion Matrix of Testing Set	
						

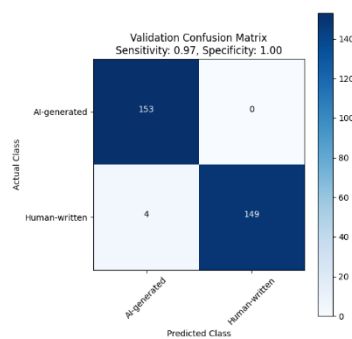


AraELECTRA-base-discriminator Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
	6	-		AIRABIC	Using Weights from Evaluation Index [4]	No training or validation. Evaluating directly using the best weights.
	Without Dediacritization Filter Layer				With Dediacritization Filter Layer	
	<p>Testing Confusion Matrix Sensitivity: 0.93, Specificity: 0.49</p> 				<p>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 0.78</p> 	
	ROC-AUC				ROC-AUC	
<p>Receiver Operating Characteristic (ROC) Curve</p> 				<p>Receiver Operating Characteristic (ROC) Curve</p> 		

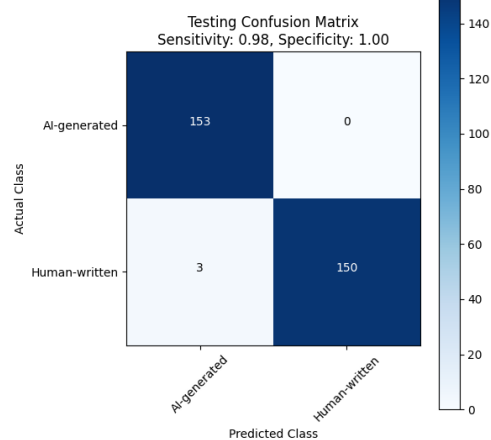
Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
7	Custom dataset			First Run on Dataset	We ran for 10 epochs. Batch size 32 with enhancements on the learning rate by applying warmup phase. "learning_rate": 3.2e-05, "initial_learning_rate": 5e-6, Linear increase from initial to LR. Then, apply cosine_annealing, which smoothly decreases the learning rate according to a cosine function.
Confusion Matrix on Validation Set					
Epoch 1		Epoch 2		Epoch 3	
Epoch 4		Epoch 5		Epoch 6	
Epoch 7		Epoch 8		Epoch 9	
Confusion Matrix of Testing Set					



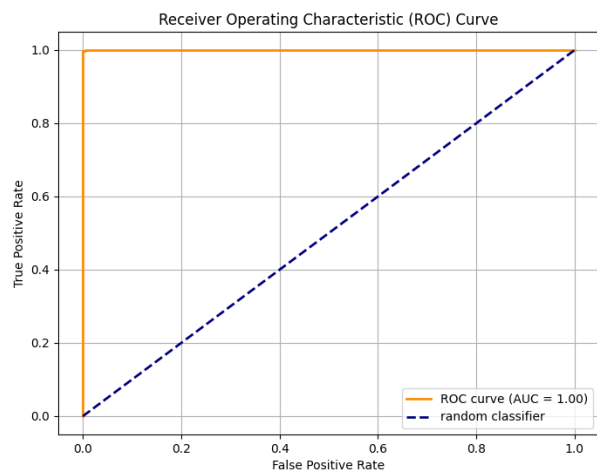
Epoch 9



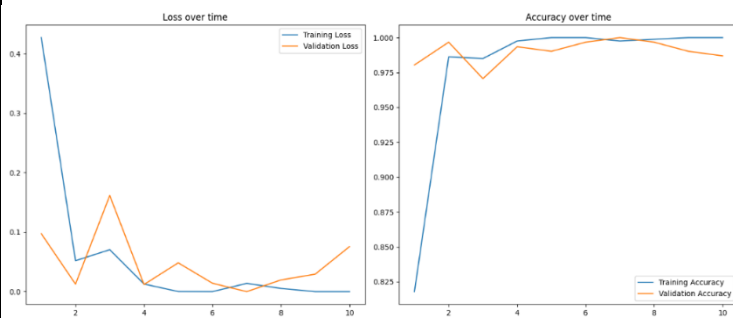
Epoch 10



ROC-AUC

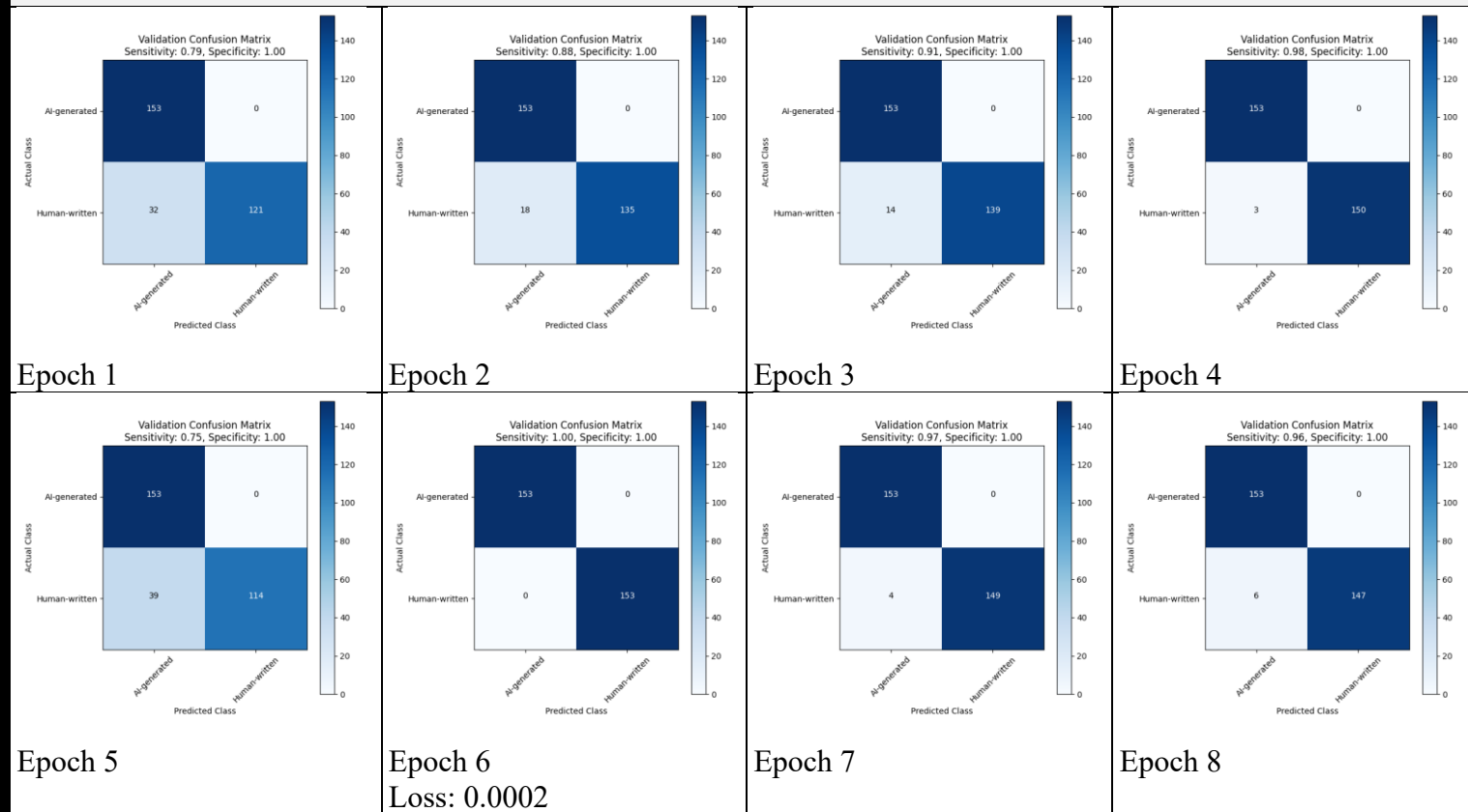


Loss and Accuracy Over Time



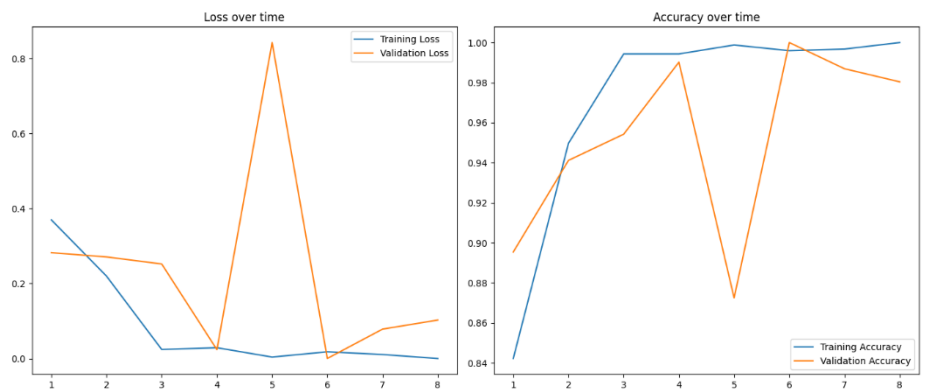
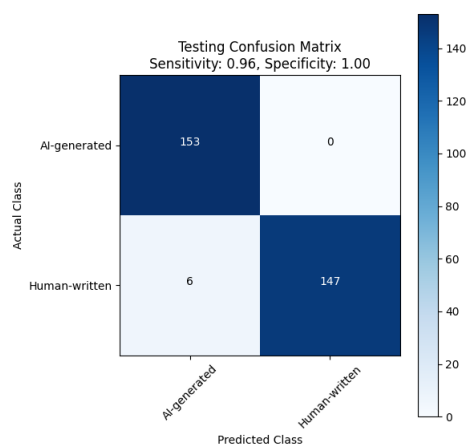
Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
7.2	Custom dataset			First Run on Dataset	<p>We ran for 8 epochs. Batch size 32 with enhancements on the learning rate by applying warmup phase.</p> <p>"learning_rate": 3.2e-05,</p> <p>"initial_learning_rate": 1e-8,</p> <p>Linear increase from initial to LR.</p> <p>"warmup_epochs": 2,</p> <p>Then, apply cosine_annealing, which smoothly decreases the learning rate according to a cosine function.</p>

Confusion Matrix on Validation Set

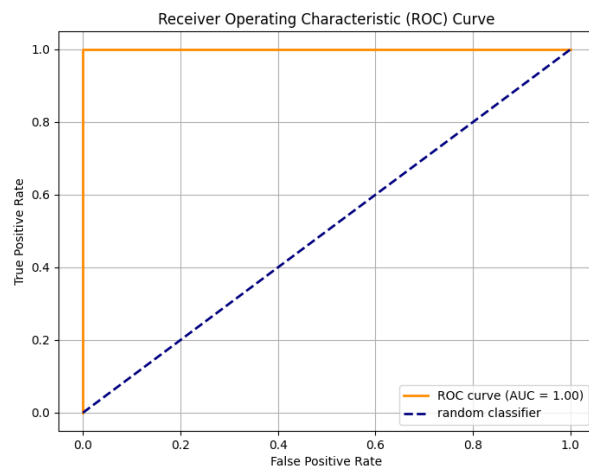


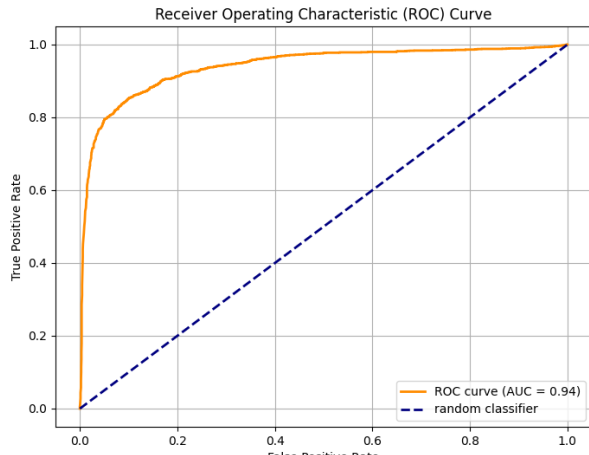
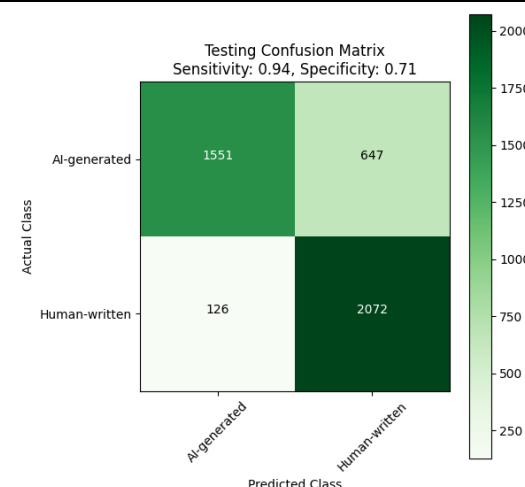
Confusion Matrix of Testing Set & Loss and Accuracy Over Time

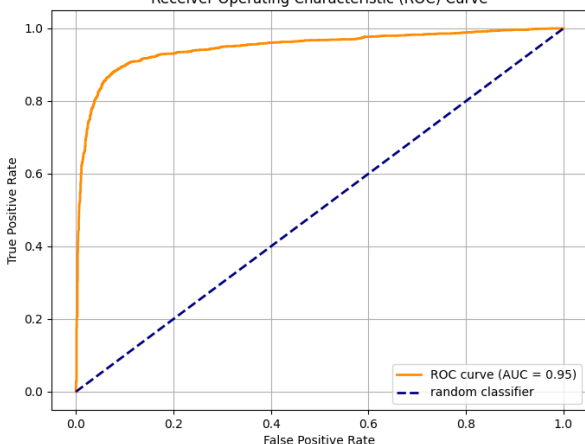
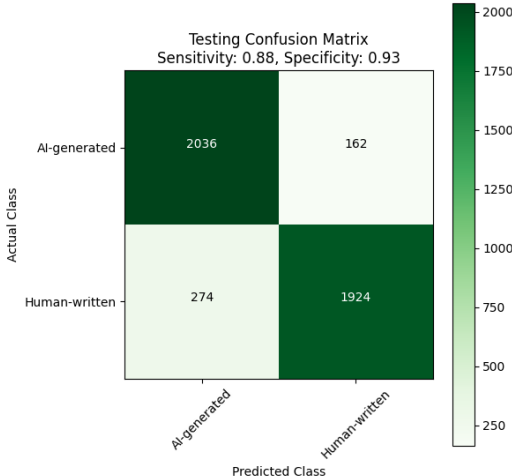
Epoch 6  
Loss: 0.0002

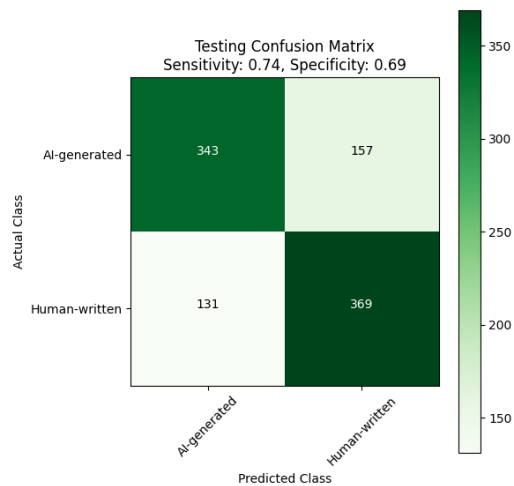
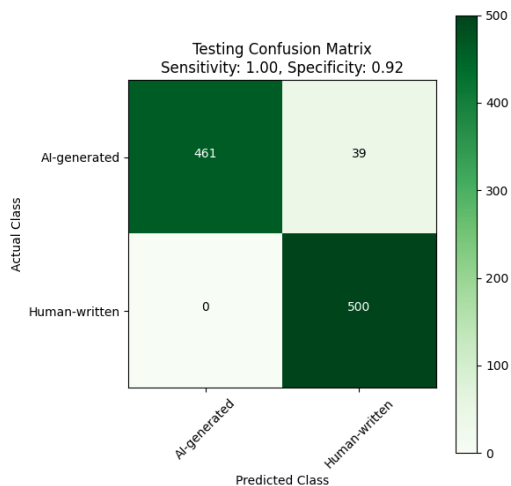
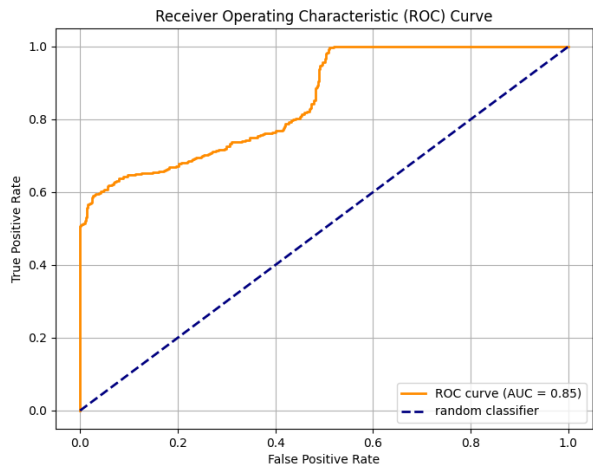
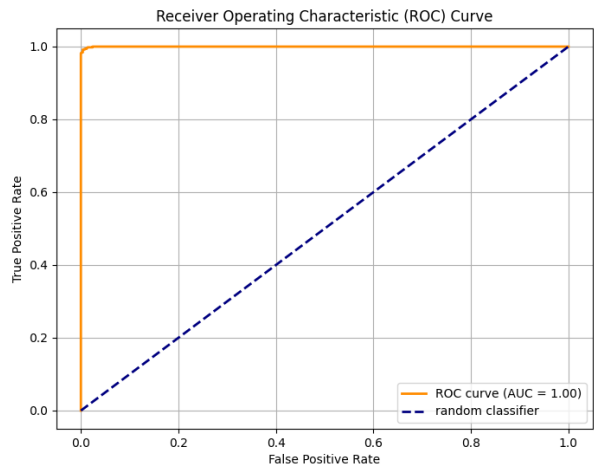


## ROC-AUC

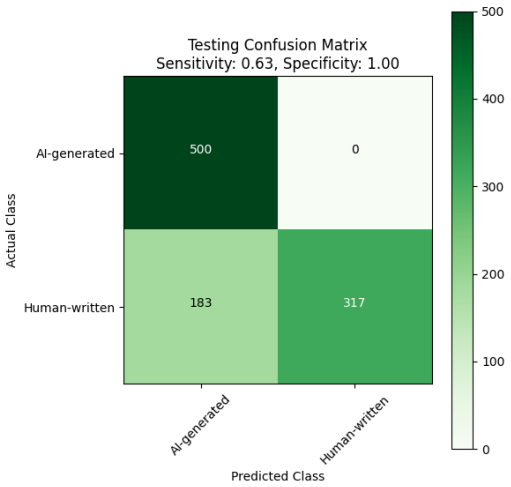
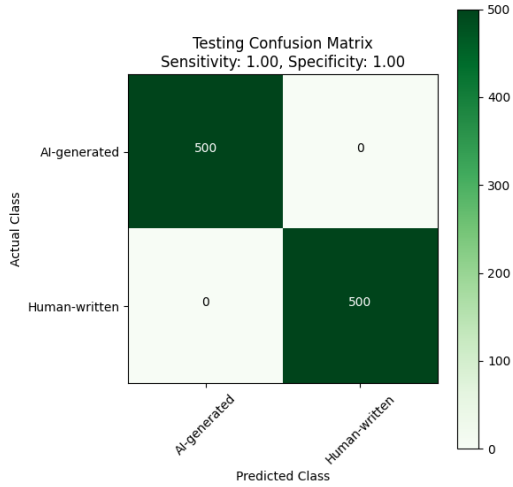
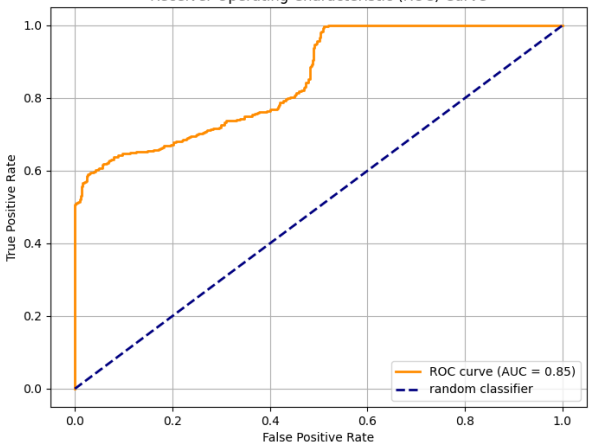
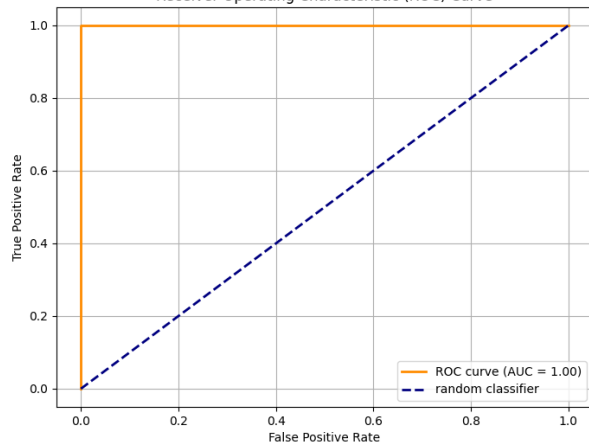


XLM-Roberta-base Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note									
	8	-		Large dataset	Using Weights from Evaluation Index [7]	No training or validation. Evaluating directly using the best weights.									
	ROC-AUC				Confusion Matrix of Testing Set										
					 <table><tr><th>Actual Class</th><th>AI-generated</th><th>Human-written</th></tr><tr><th>AI-generated</th><td>1551</td><td>647</td></tr><tr><th>Human-written</th><td>126</td><td>2072</td></tr></table>		Actual Class	AI-generated	Human-written	AI-generated	1551	647	Human-written	126	2072
	Actual Class	AI-generated	Human-written												
AI-generated	1551	647													
Human-written	126	2072													

XLM-Roberta-base Model	Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
	8.2	-		Large dataset	Using Weights from Evaluation Index [7.2]	No training or validation. Evaluating directly using the best weights.
	ROC-AUC				Confusion Matrix of Testing Set	
						

Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note																		
9	-		AIRABIC	Using Weights from Evaluation Index [7]	No training or validation. Evaluating directly using the best weights.																		
Without Dediacritization Filter Layer				With Dediacritization Filter Layer																			
<p>Testing Confusion Matrix Sensitivity: 0.74, Specificity: 0.69</p>  <table><tr><th>Actual Class \ Predicted Class</th><th>AI-generated</th><th>Human-written</th></tr><tr><th>AI-generated</th><td>343</td><td>157</td></tr><tr><th>Human-written</th><td>131</td><td>369</td></tr></table>				Actual Class \ Predicted Class	AI-generated	Human-written	AI-generated	343	157	Human-written	131	369	<p>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 0.92</p>  <table><tr><th>Actual Class \ Predicted Class</th><th>AI-generated</th><th>Human-written</th></tr><tr><th>AI-generated</th><td>461</td><td>39</td></tr><tr><th>Human-written</th><td>0</td><td>500</td></tr></table>		Actual Class \ Predicted Class	AI-generated	Human-written	AI-generated	461	39	Human-written	0	500
Actual Class \ Predicted Class	AI-generated	Human-written																					
AI-generated	343	157																					
Human-written	131	369																					
Actual Class \ Predicted Class	AI-generated	Human-written																					
AI-generated	461	39																					
Human-written	0	500																					
ROC-AUC				ROC-AUC																			
<p>Receiver Operating Characteristic (ROC) Curve</p>  <p>ROC curve (AUC = 0.85) random classifier</p>				<p>Receiver Operating Characteristic (ROC) Curve</p>  <p>ROC curve (AUC = 1.00) random classifier</p>																			



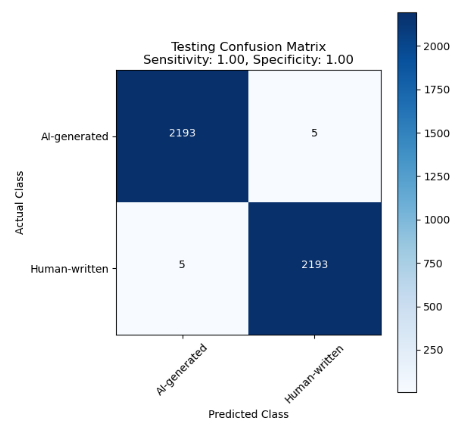
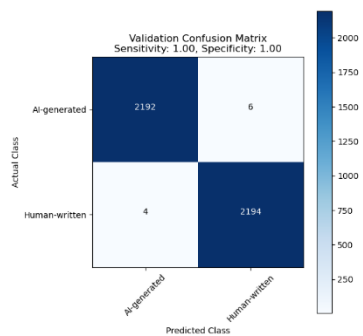
Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note																		
9.2	-		AIRABIC	Using Weights from Evaluation Index [7.2]	No training or validation. Evaluating directly using the best weights.																		
Without Dediacrization Filter Layer				With Dediacrization Filter Layer																			
<div><p>Testing Confusion Matrix Sensitivity: 0.63, Specificity: 1.00</p><table border="1"><thead><tr><th>Actual \ Predicted</th><th>AI-generated</th><th>Human-written</th></tr></thead><tbody><tr><th>AI-generated</th><td>500</td><td>0</td></tr><tr><th>Human-written</th><td>183</td><td>317</td></tr></tbody></table></div>				Actual \ Predicted	AI-generated	Human-written	AI-generated	500	0	Human-written	183	317	<div><p>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 1.00</p><table border="1"><thead><tr><th>Actual \ Predicted</th><th>AI-generated</th><th>Human-written</th></tr></thead><tbody><tr><th>AI-generated</th><td>500</td><td>0</td></tr><tr><th>Human-written</th><td>0</td><td>500</td></tr></tbody></table></div>		Actual \ Predicted	AI-generated	Human-written	AI-generated	500	0	Human-written	0	500
Actual \ Predicted	AI-generated	Human-written																					
AI-generated	500	0																					
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AI-generated	500	0																					
Human-written	0	500																					
ROC-AUC				ROC-AUC																			
<div><p>Receiver Operating Characteristic (ROC) Curve</p><p>ROC curve (AUC = 0.85) random classifier</p></div>				<div><p>Receiver Operating Characteristic (ROC) Curve</p><p>ROC curve (AUC = 1.00) random classifier</p></div>																			

Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
10	Large dataset			First Run on Dataset	We ran for 10 epochs, batch size 64 with enhancements on the learning rate by applying warmup linear phase. "learning_rate": 3.2e-06, "initial_learning_rate": 5e-8, "warmup_epochs": 5, Then, apply cosine_annealing, which smoothly decreases the learning rate according to a cosine function.

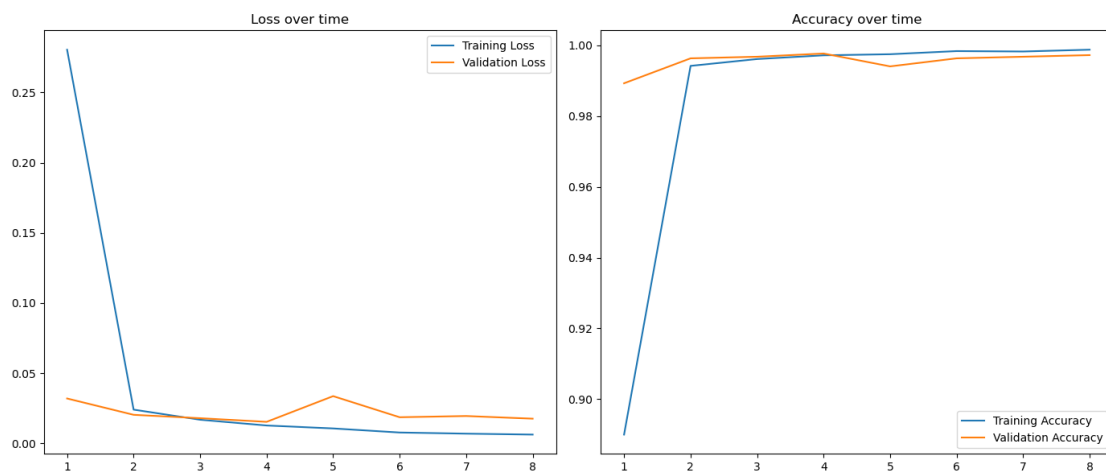
Confusion Matrix on Validation Set

<p>Validation Confusion Matrix Sensitivity: 0.98, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 0.99, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>
Epoch 1	Epoch 2	Epoch 3	Epoch 4
<p>Validation Confusion Matrix Sensitivity: 0.99, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 0.99, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>	<p>Validation Confusion Matrix Sensitivity: 1.00, Specificity: 1.00</p> <p>Actual Class</p> <p>Predicted Class</p>
Epoch 5	Epoch 6	Epoch 7	Epoch 8
Confusion Matrix of Testing Set			

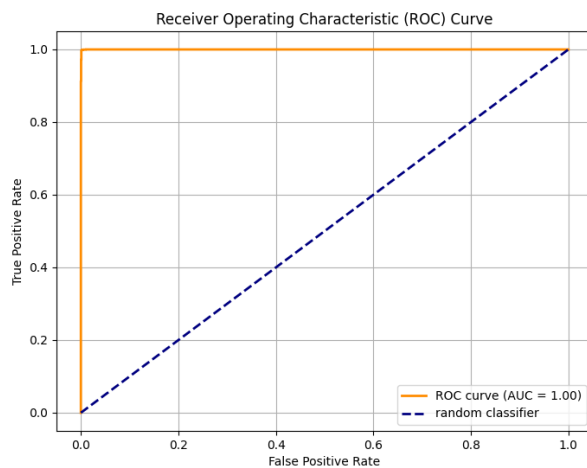
Epoch 9



## Loss and Accuracy Over Time

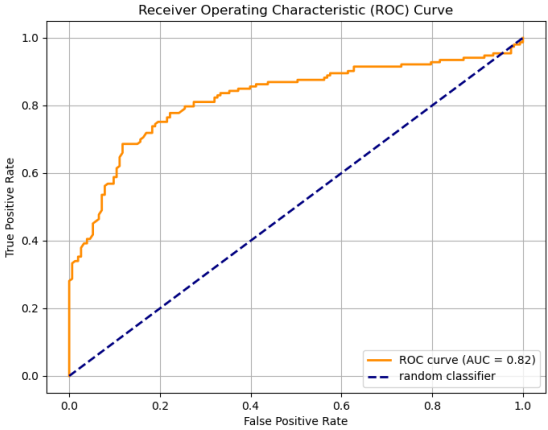
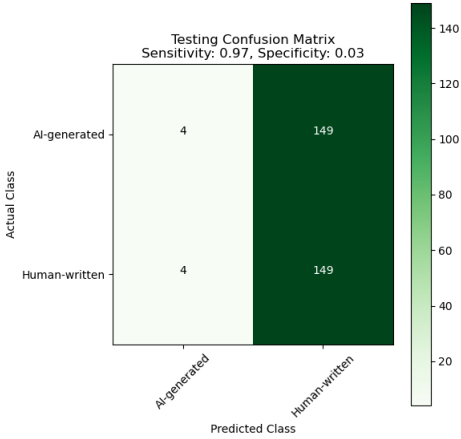


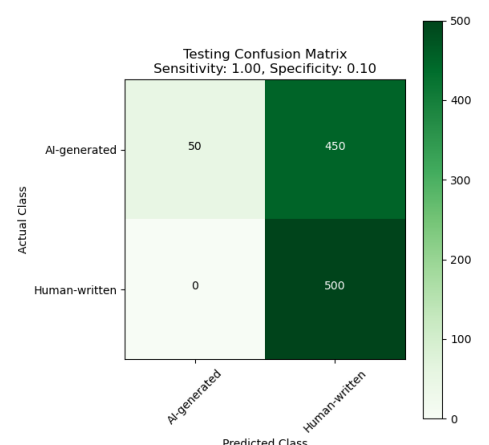
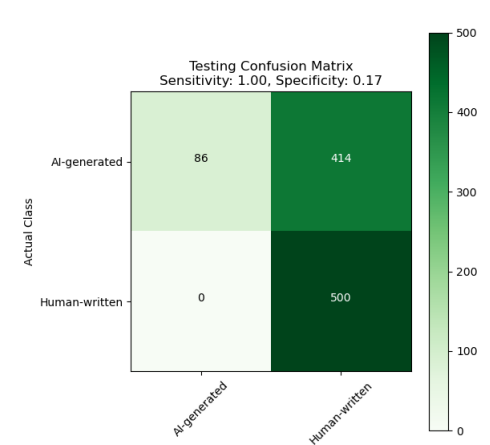
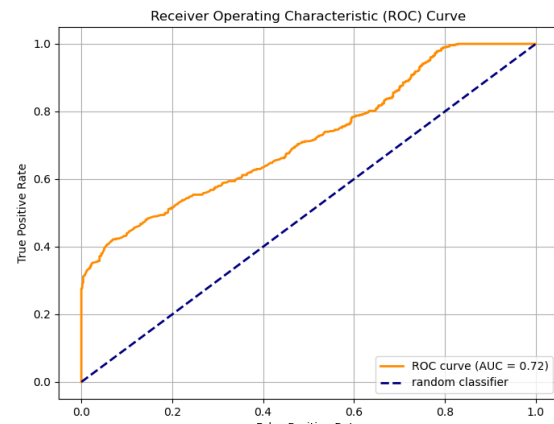
## ROC-AUC



Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
11		-	Custom dataset	Using Weights from Evaluation Index [10]	No training or validation. Evaluating directly using the best weights.

Confusion Matrix of Testing Set and ROC-AUC



Evaluation Index	Trained	Validated	Tested	Experiment Weight Origin	Note
12		-	AIRABIC	Using Weights from Evaluation Index [10]	No training or validation. Evaluating directly using the best weights.
Without Dediacrization Filter Layer				With Dediacrization Filter Layer	
<p>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 0.10</p> 				<p>Testing Confusion Matrix Sensitivity: 1.00, Specificity: 0.17</p> 	
ROC-AUC				ROC-AUC	
<p>Receiver Operating Characteristic (ROC) Curve</p> 				<p>Receiver Operating Characteristic (ROC) Curve</p> 