1) The accuracies obtained for each of the methods are demonstrated below. I used the number of epochs as an input parameter given by the user. For OVA and AVA, epochs=100 was optimal and for the binary tournament approach, epochs=10 was optimal.

In the binary tournament tree, training and testing algorithms are recursive. During training, each node separates its labels into two groups of equal size and applies the training algorithm recursively on them. The algorithm stops when a list of length 1 is encountered.

#### OVA:

Epochs	Train Accuracy	Validation Accuracy	Test Accuracy
1	33.73	36.47	30.59
10	44.97	29.41	27.06
50	48.52	27.06	34.12
100	59.76	37.65	42.35
1000	59.17	24.71	29.41

#### AVA:

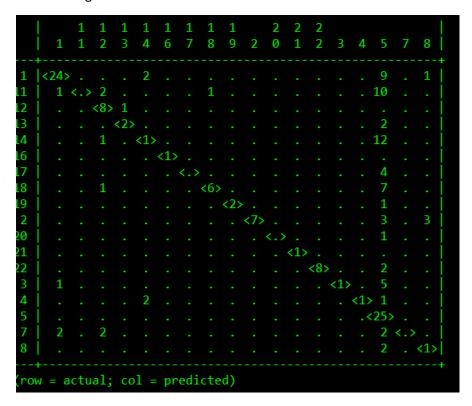
Epochs	Train Accuracy	Validation Accuracy	Test Accuracy
1	30.18	20.00	23.53
10	70.41	38.82	38.82
50	84.62	31.76	30.59
100	81.07	35.29	38.82
1000	90.53	42.35	36.47

### Binary Tournament Tree:

Epochs	Train Accuracy	Validation Accuracy	Test Accuracy
1	25.44	17.65	21.18
10	55.03	36.47	45.88
50	49.70	31.76	37.65
100	46.75	29.41	27.06
1000	57.40	38.82	40.00

2) The confusion matrices for the optimal epochs is demonstrated below. OVA and AVA show a lot of misclassification for label 5. However, the binary tournament shows a lot of misclassification for label 1.

## OVA training set:



### OVA validation set:

		1	1	1	1	1	1	1	1	1		2	2					
	1	0	1	2	3	4	5	7	8	9	2	0	2	3	4	5	7	8
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14						<.>							2			6		-
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17								<.>								2		- [
18									<2>							6		- 1
19										<.>						2		
2											<3>					1		2
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<b>22</b> 3													<6>	٠.				- 1
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	+																	+
(ro	N = 6	actu	al;	со	1 =	pr	edi	cte	d)									

## OVA test set:

# AVA training set:

		1	1	1 2	1	1	1 6	1 7	1 8	1	2	2	2	2	3	4	5	7	8   8
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8											1								<2>
 (ro	+- W	= a	ctu	al;	co	 L =	pr	edi	te	 d)									+

### AVA validation set:

### AVA test set:

	   1	1 0	1 1	1 2	1 3	1 4	1 5	1 7	1 8	1 9	2	2	3	4	5	6	7	8
	+																	+
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15	1						<.>											. 1
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## Binary Tournament training set:

# Binary Tournament validation set:

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11	2		<.>			1		1	1									.	
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13	1				<.>	1												.	
14	1		1			<5>									1			.	
15						1	<.>											.	
17						1		<1>										.	
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22						1							<5>					.	
3	1												1	<.>				.	
4	1					2							1		<.>				
5			2						1							<.>			
7	3		1			1									1		<.>		
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(ro	w = a	ictu	al;	CO	1 =	pr	edi	cte	d)										

## Binary Tournament test set: