

I-BIOM: Zadanie č.3

ROZPOZNÁVANIE TVÁRÍ

- Vytvorte množinu tvárí z videa - pomocou lokalizácií z predošlého zadania tváre vyrovnajte podľa očí a vystrihnite **2b**.

Pre každý jeden frame sa podľa informácií z predošlého zadania najskôr otočí obrázok pomocou matice podľa očí a následne sa vyreže podľa informácií, kde sa nachádza tvár. A výstupy vyzerajú takto



Katharine_Hepburn_4 obrázok, kde sú vyrezané len tváre bez vyrovnania



Katharine_Hepburn_4 - tentokrát už je vyrovnané podľa očí

Bez vyrovnania podľa očí

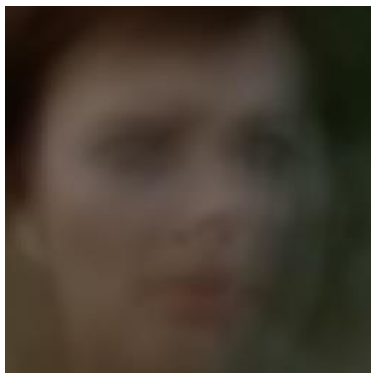


Vyrovnané podľa očí

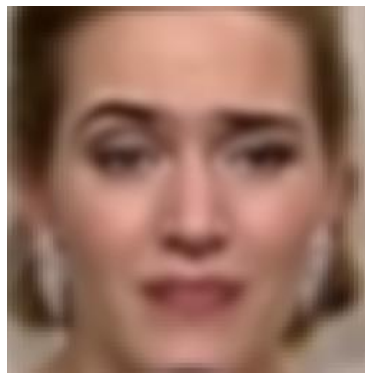


– Vytvorte priemernú tvár 1b.

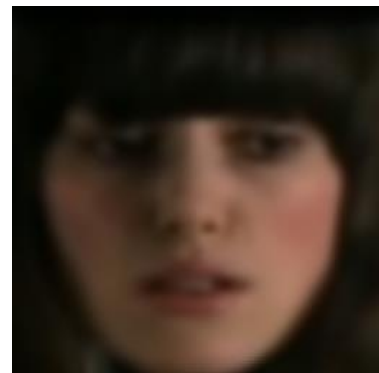
Následne boli všetky tváre spriemerované. Niektoré vyzerajú lepšie ako ostatné.



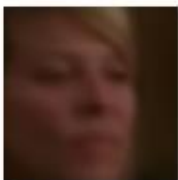
Karin_Viard_1_faces



Kate_Winslet_1_faces



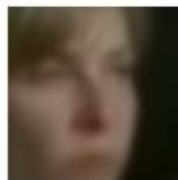
Keira_Knightley_3_faces



Kate_Capshaw_1_faces.jpg



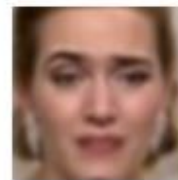
Kate_Capshaw_2_faces.jpg



Kate_Capshaw_4_faces.jpg



Kate_Winslet_0_faces.jpg



Kate_Winslet_1_faces.jpg



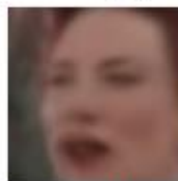
Kate_Winslet_5_faces.jpg



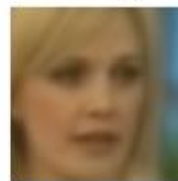
Katharine_Hepburn_1_faces.jpg



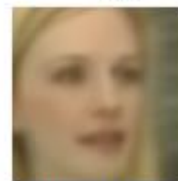
Katharine_Hepburn_3_faces.jpg



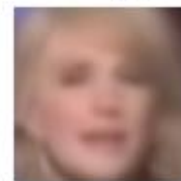
Katharine_Hepburn_4_faces.jpg



Kathryn_Morris_1_faces.jpg



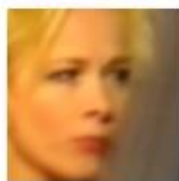
Kathryn_Morris_2_faces.jpg



Kathryn_Morris_4_faces.jpg



Kathryn_Morris_5_faces.jpg



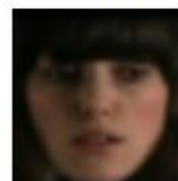
Katja_Riemann_0_faces.jpg



Katja_Riemann_1_faces.jpg



Keira_Knightley_1_faces.jpg



Keira_Knightley_3_faces.jpg



Keith_Olbermann_0_faces.jpg



Keith_Olbermann_1_faces.jpg



Keith_Olbermann_2_faces.jpg



Keith_Olbermann_5_faces.jpg



Keith_Tyson_1_faces.jpg



Keith_Tyson_2_faces.jpg

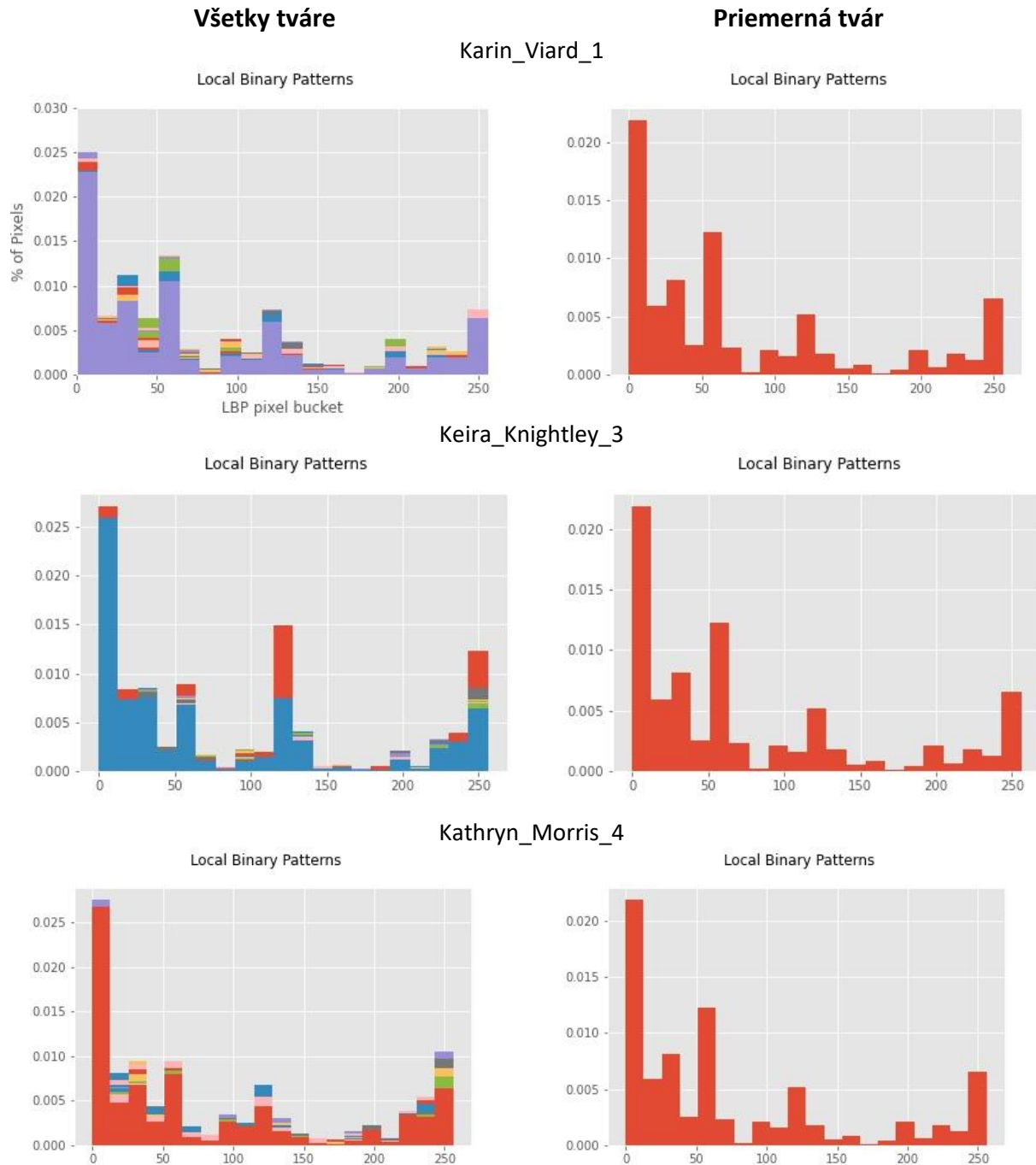


Kelsey_Grammer_1_faces.jpg

- Z každej tváre z množiny (aj z priemernej) vypočítajte príznaky na verifikáciu tvári pomocou aspoň dvoch metód počítačového videnia **2x1.5b**. Na výber máte viacero metód:

* Histogramy LBP,

Pomocou *local binary pattern* sa z každej tváre získali príznaky na verifikáciu.



* Histogramy orientovaných gradientov,



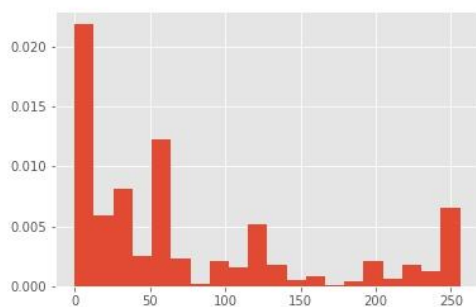
– Porovnajte príznaky tváří z dvojíc pre:

* priemerné tváre **1b**,

TruePairs

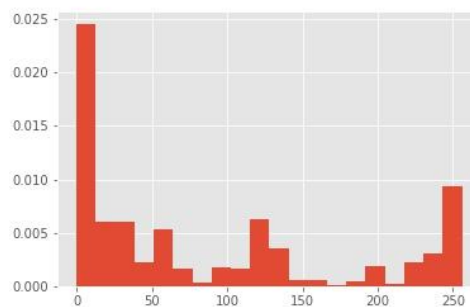
Karin_Viard_1

Local Binary Patterns



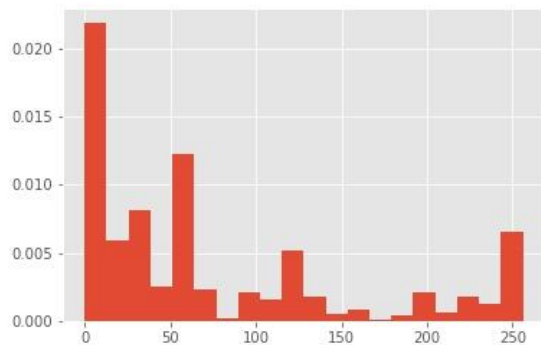
Karin_Viard_3

Local Binary Patterns



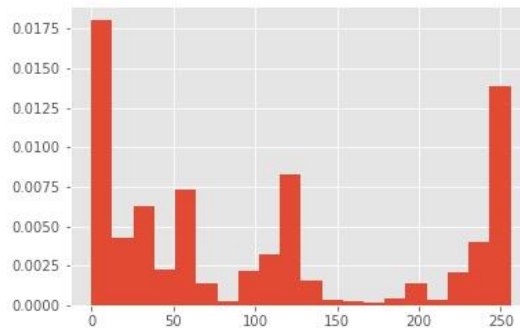
Keith_Olbermann_0

Local Binary Patterns



Keith_Olbermann_2

Local Binary Patterns



LBP

LBP - Euklidovské vzdialenosti							
Priemerná tvár		Náhodná tvár		Každá s každou		Najviac podobné	
TRUE	FALSE	TRUE	FALSE	TRUE	FALSE	TRUE	FALSE
0.0947	0.0468	0.0566	0.1047	0.0639	0.0914	0.0196	0.0249
0.0555	0.0585	0.0350	0.0766	0.0424	0.0897	0.0244	0.0466
0.0622	0.0414	0.1080	0.1246	0.0628	0.1018	0.0272	0.0391
0.0411	0.0440	0.1634	0.0620	0.1334	0.0989	0.0623	0.0305
0.0451	0.0328	0.1772	0.0475	0.1100	0.0979	0.0257	0.0315
0.0347	0.0370	0.1300	0.0624	0.1862	0.0961	0.0914	0.0198
0.1236	0.0614	0.0571	0.0425	0.0492	0.0943	0.0214	0.0202
0.0181	0.0636	0.0233	0.0352	0.0463	0.0946	0.0123	0.0216
0.0779	0.0200	0.0518	0.0463	0.0644	0.0936	0.0341	0.0306
0.0344	0.0420	0.0981	0.1178	0.0581	0.1002	0.0222	0.0360
0.0587	0.0448	0.0900	0.0720	0.0817	0.0958	0.0340	0.0301

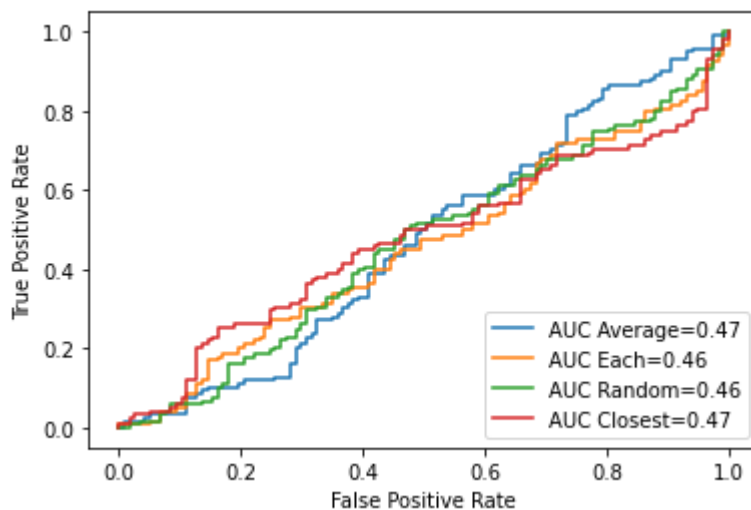
True Pairs



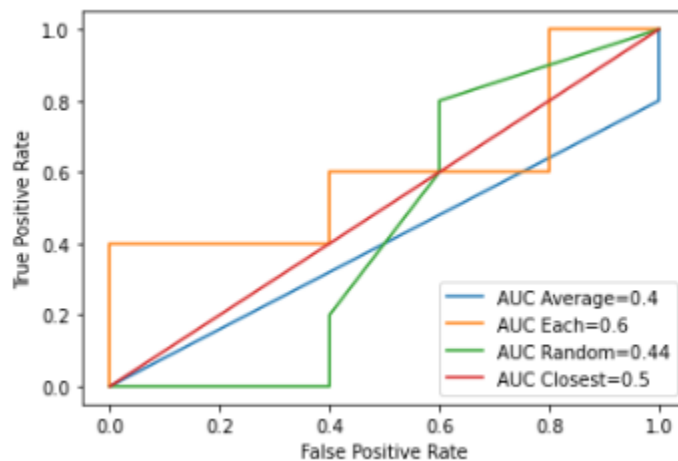
False Pairs



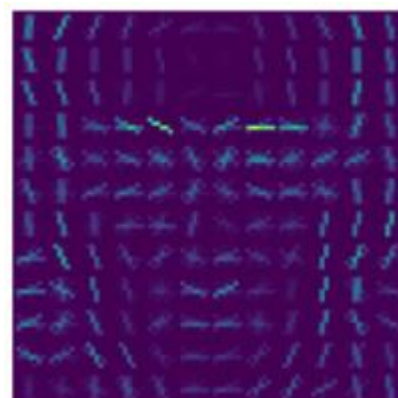
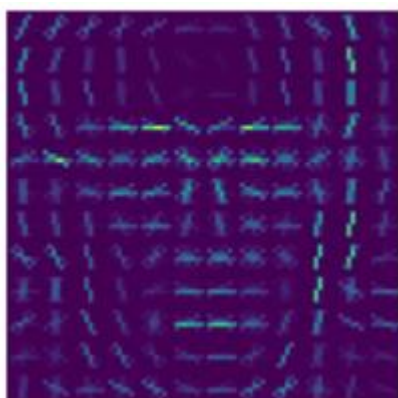
Spustené na celej množine pomocou linear SVM. Veľmi zlé výsledky, horšie než náhoda. Pre 10 prvkov to bola náhoda, teda tadiaľto cesta nevedie.



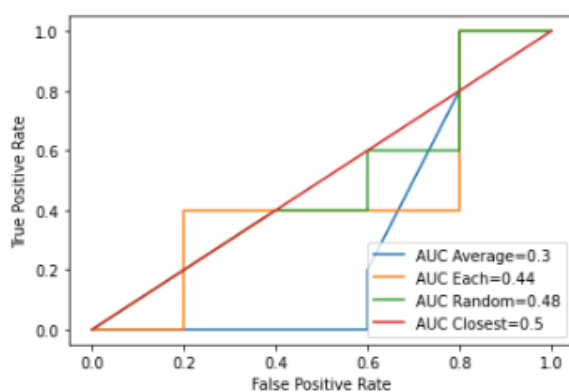
Porovnanie pomocou Kolmogorov-Smirnov. Výsledky neboli omnoho lepšie.



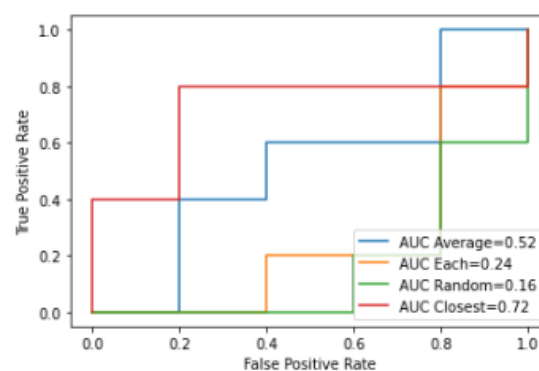
HOG



HOG - Kolmogorov-Smirnov							
Priemerná tvár		Náhodná tvár		Každá s každou		Najviac podobné	
TRUE	FALSE	TRUE	FALSE	TRUE	FALSE	TRUE	FALSE
0.0000	0.0000	0.0000	0.0000	0.1890	0.0000	0.0000	0.0000
0.0183	0.0000	0.0000	0.3911	0.0037	0.0740	0.0000	0.0000
0.5736	0.2407	0.5842	0.0000	0.0620	0.6609	0.0000	0.0000
0.0413	0.0775	0.0000	0.0000	0.7795	0.5609	0.0000	0.0000
0.1307	0.1921	1.0000	0.0000	0.7996	0.6829	0.0000	0.0000
0.0818	0.0222	0.0000	0.0000	0.0138	0.0010	0.0000	0.0000
0.1243	0.0000	0.0000	1.0000	0.0009	0.9868	0.0000	0.0000
0.1750	0.0001	0.0000	1.0000	0.2208	0.9682	0.0000	0.0000
0.1750	0.8192	1.0000	0.9972	0.6806	0.4267	0.0000	0.0000
0.2979	0.0000	1.0000	1.0000	0.6164	0.4567	0.0000	0.0000
0.1618	0.1352	0.3584	0.4388	0.3366	0.4818	0.0000	0.0000



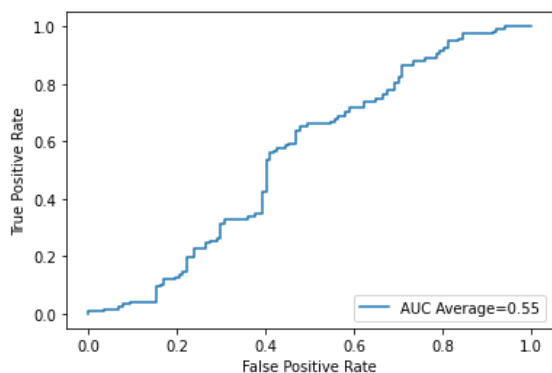
Kolmogorov-Smirnov (graf)



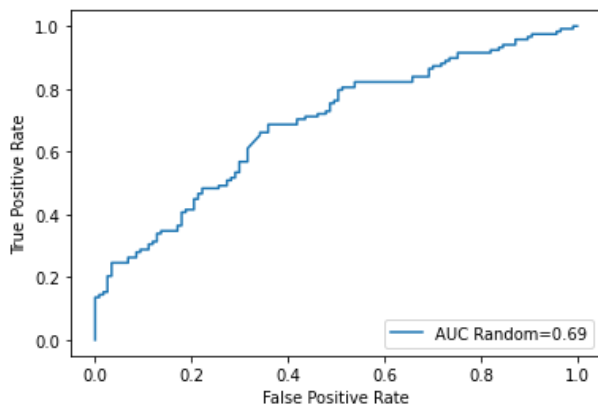
Euklidovské vzdialenosti

HOG - Euklidovské vzdialenosti							
Priemerná tvár		Náhodná tvár		Každá s každou		Najviac podobné	
TRUE	FALSE	TRUE	FALSE	TRUE	FALSE	TRUE	FALSE
9.9579	10.6759	8.7014	10.8705	9.7706	10.2591	7.8551	9.0896
6.3676	10.8432	8.3654	10.3116	8.1641	10.2277	6.1730	9.4737
7.0056	5.4130	9.3817	8.7457	9.2843	8.5423	8.2543	7.6198
4.0109	8.6653	9.8844	10.7101	9.7155	10.7083	7.1134	9.4883
10.2625	7.6821	9.2440	11.3748	9.2379	10.8488	8.0937	9.5582
7.0842	8.2157	9.4002	9.3704	8.9220	9.3543	7.9885	8.4494
9.3474	8.0594	8.8457	9.7561	8.9595	10.0962	7.7246	9.2422
4.0350	9.3222	9.3246	10.2409	9.3542	9.8110	7.5612	9.0385
8.1241	3.4155	10.1590	9.0319	10.2327	8.7779	9.7802	7.7386
6.7312	7.2717	8.5660	9.6032	7.9090	9.9403	6.1446	9.0094
7.2927	7.9564	9.1873	10.0015	9.1550	9.8566	7.6689	8.8708

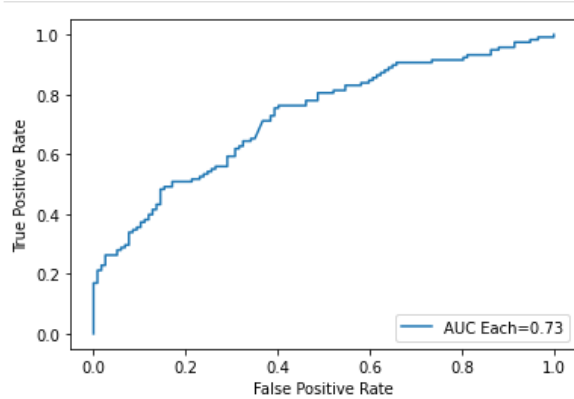
Hodnoty sú omnoho vyššie, keďže rozmer vracaného vektora je tu vyšší. Taktiež si môžeme všimnúť že pri porovnaní najbližších obrázkoch, máme celkom obstojne úspešnosti.



		Predicted Values	
		True	False
Actual Values	True	70 (True Positive)	47 (False Negative)
	False	66 (False Positive)	52 (True Negative)

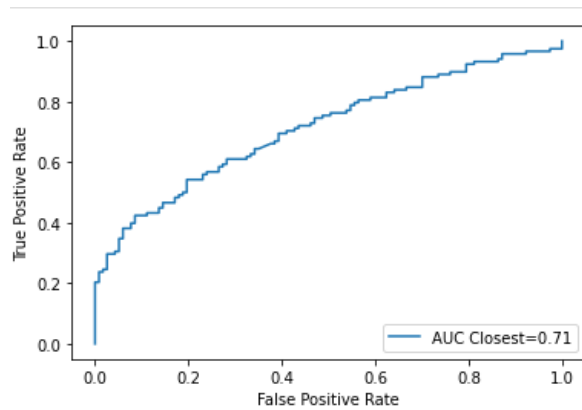


		Predicted Values	
		True	False
Actual Values	True	85 (True Positive)	32 (False Negative)
	False	58 (False Positive)	60 (True Negative)



HOG - Each face

		Predicted Values	
		True	False
Actual Values	True	77 (True Positive)	40 (False Negative)
	False	42 (False Positive)	76 (True Negative)

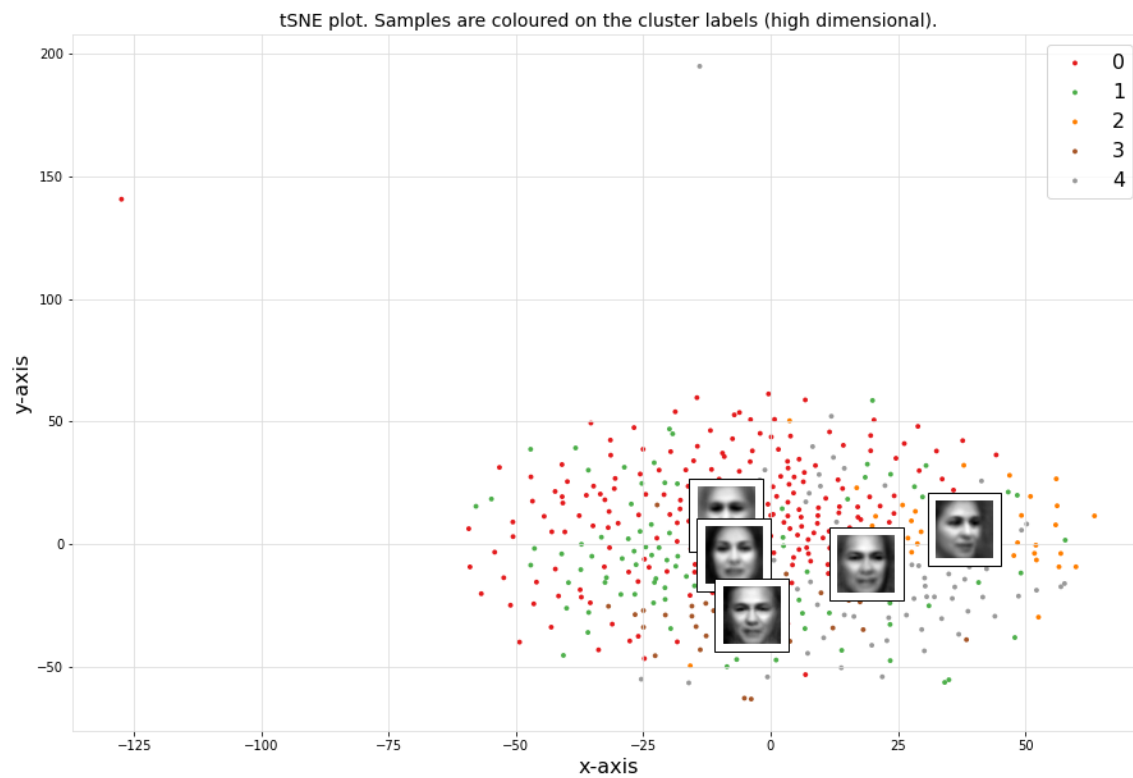


HOG - Closest face

		Predicted Values	
		True	False
Actual Values	True	79 (True Positive)	38 (False Negative)
	False	45 (False Positive)	73 (True Negative)

All Average Faces – HOG clustering

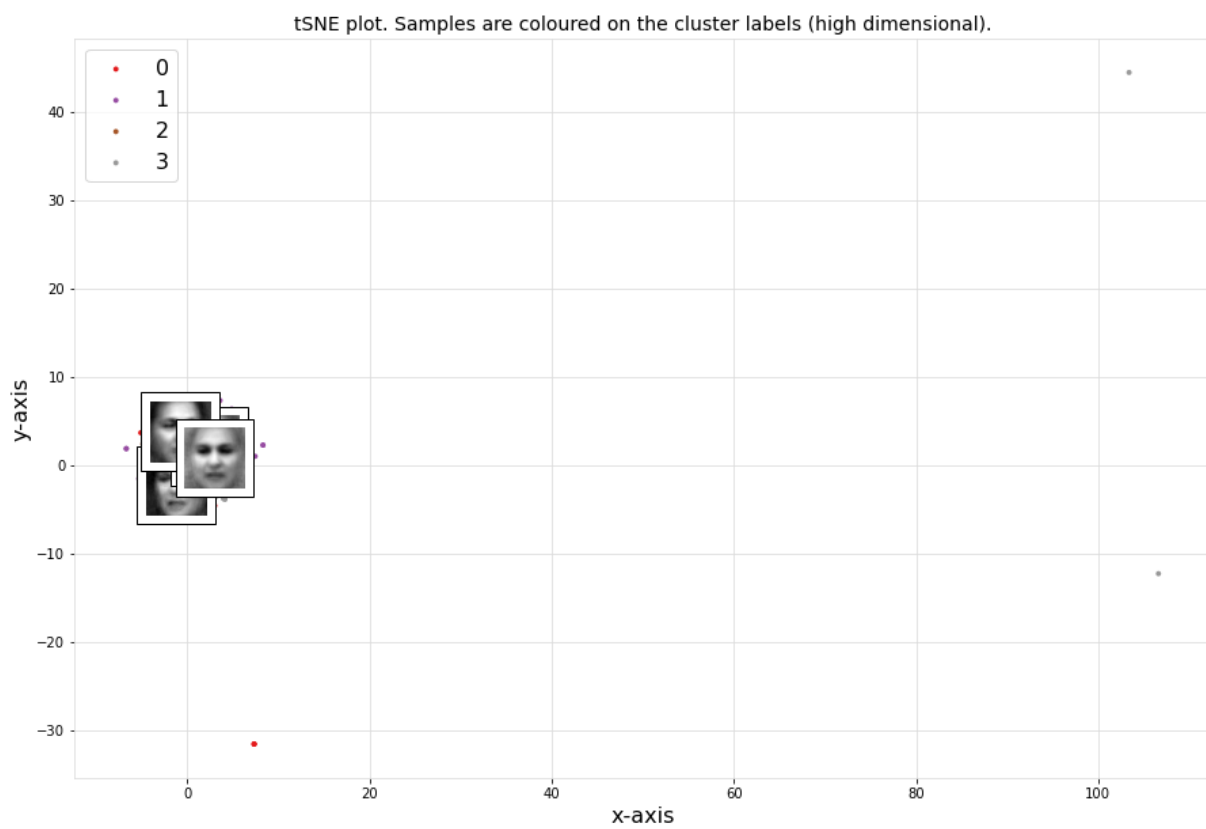
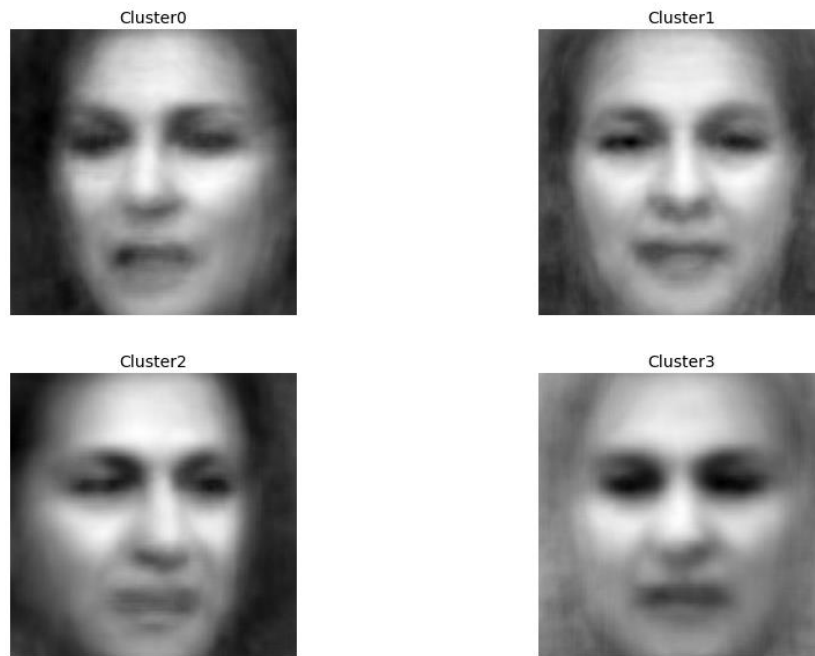




Images in cluster 1



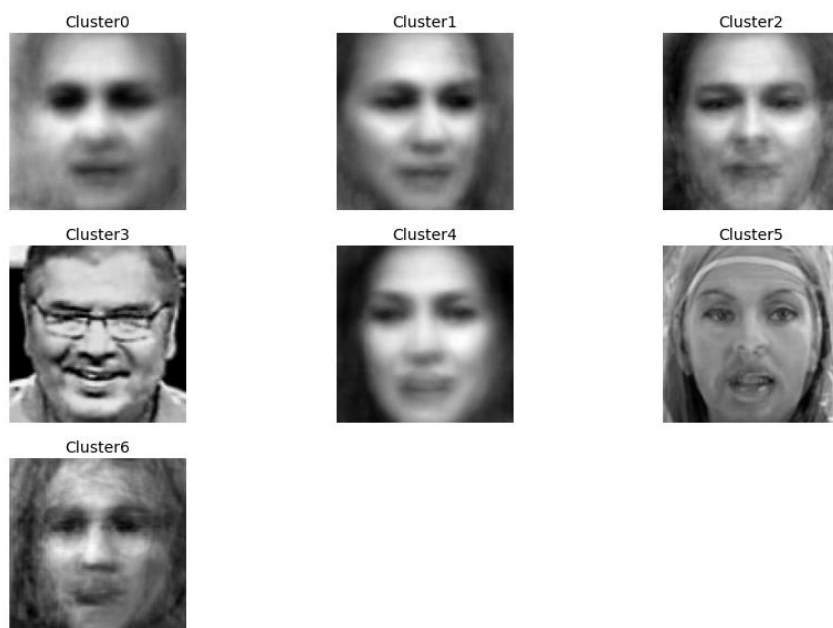
All Closest Faces – HOG clustering



Images in cluster 1



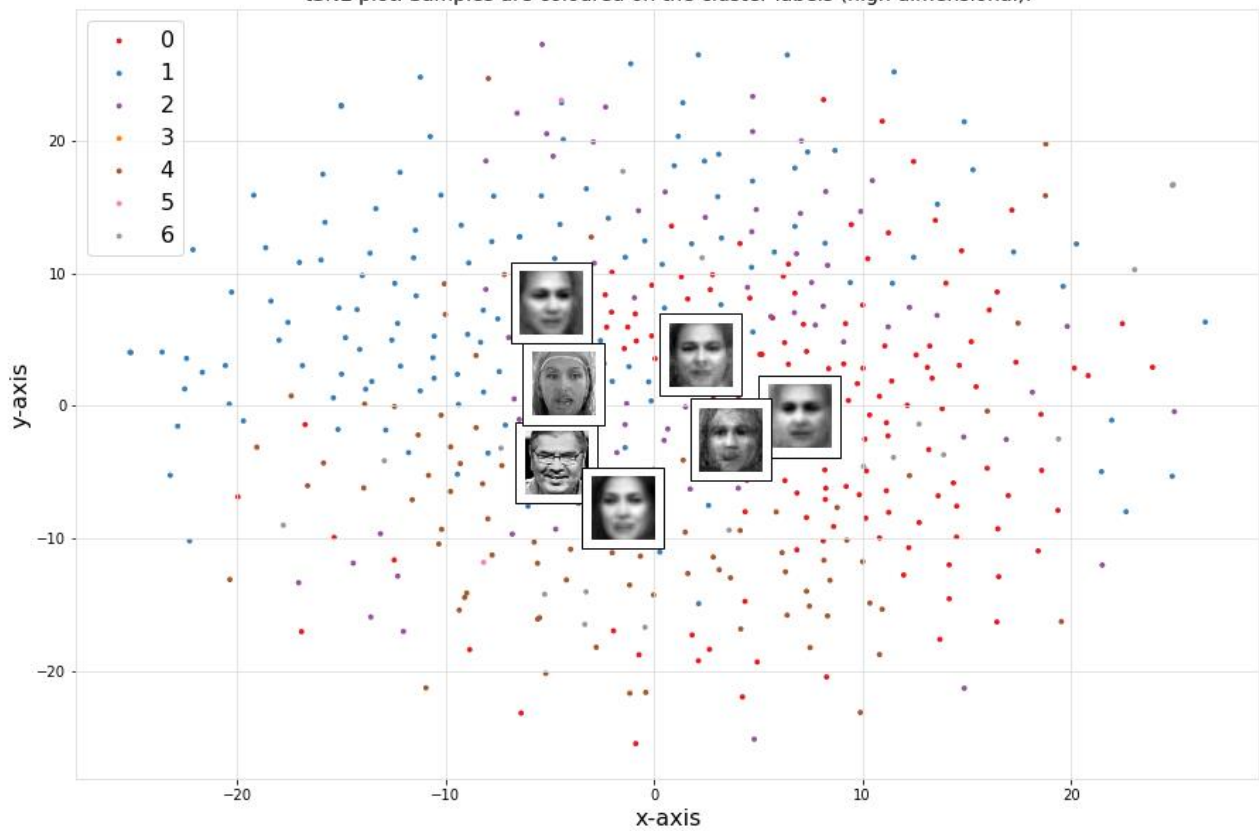
All Random Faces – HOG clustering



Images in cluster 1

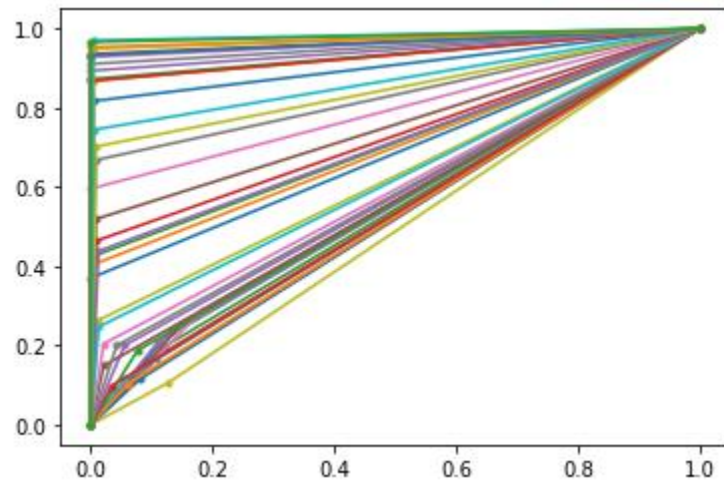


tSNE plot. Samples are coloured on the cluster labels (high dimensional).



CNN – Closest Faces

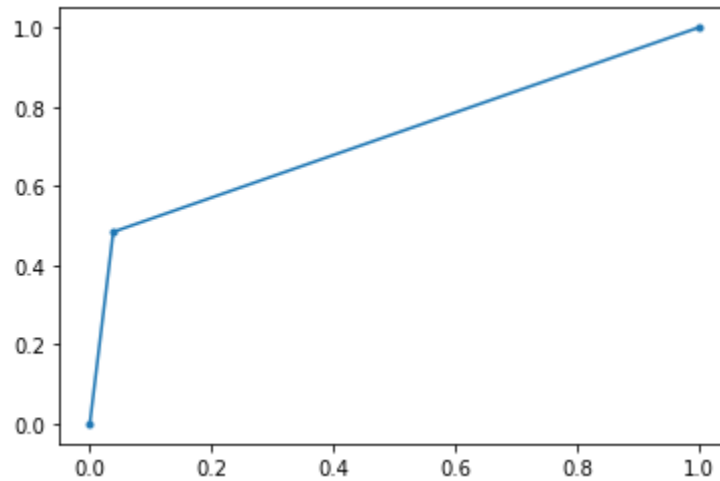
485 obrázkov tvárí a 195 ľudí. VGG16 model



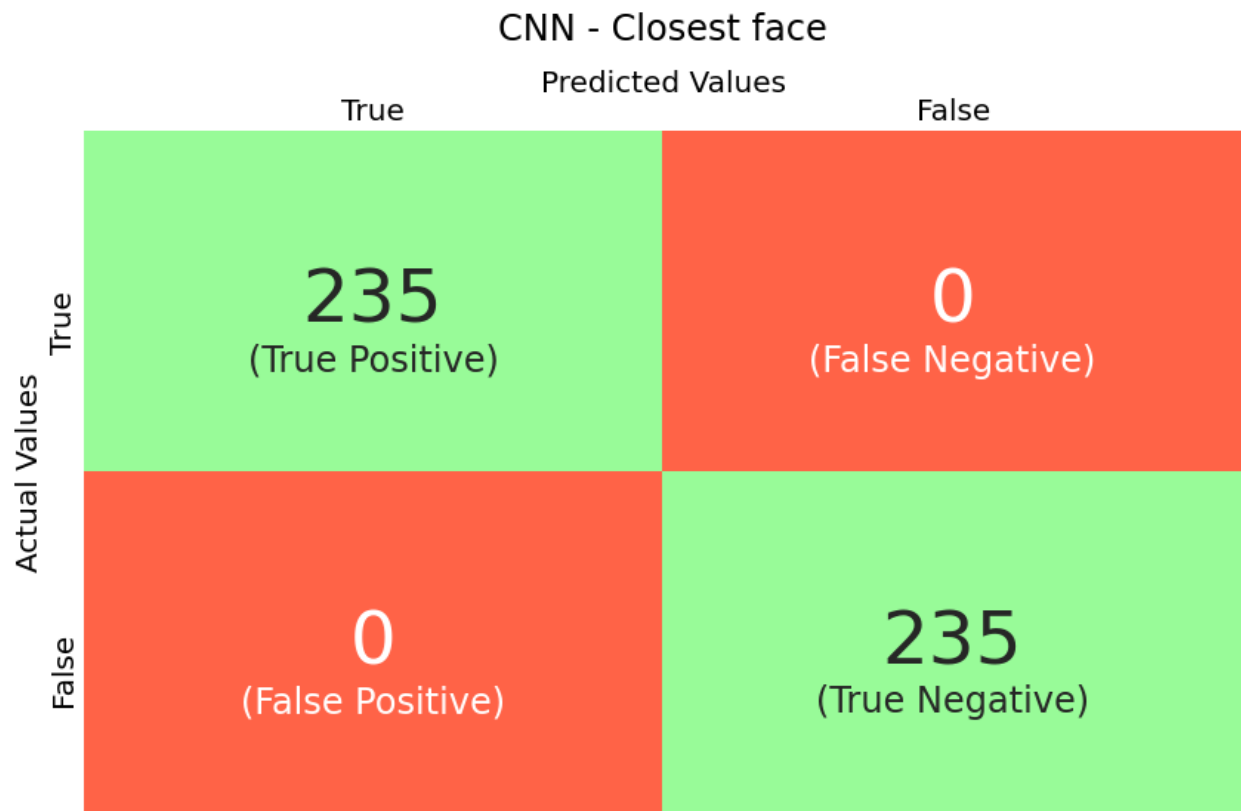
ROC pre každú epochu

```
Epoch 40/50  
30/30 [=====] - 2s 58ms/step - loss: 0.7245 - accuracy: 0.8081 - val_loss: 0.1381 - val_accuracy: 0.9833  
Epoch 41/50  
30/30 [=====] - 2s 59ms/step - loss: 0.6206 - accuracy: 0.8294 - val_loss: 0.2869 - val_accuracy: 0.9667  
Epoch 42/50  
30/30 [=====] - 2s 59ms/step - loss: 0.5442 - accuracy: 0.8678 - val_loss: 0.1148 - val_accuracy: 0.9812  
Epoch 43/50  
30/30 [=====] - 2s 59ms/step - loss: 0.5644 - accuracy: 0.8657 - val_loss: 0.1410 - val_accuracy: 0.9833
```

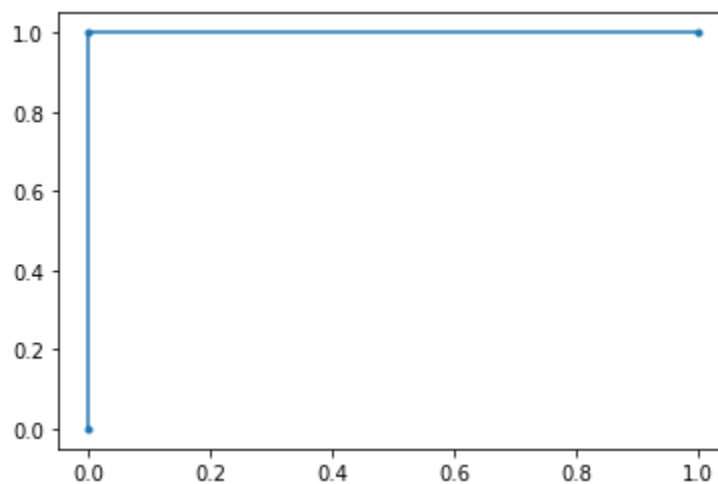
Konečný priebeh tréningu



Priemerná ROC pre všetky epochy



Konfúzna matica pre CNN - najbližšia tvár



Finálne ROC

Fotky boli rozdelené na 195 clustrov. Každý cluster obsahuje fotky jednej osoby. Napríklad:

```
groups[125]

['../closestFaces/Leszek_Miller_3_faces.jpg',
 '../closestFaces/Leszek_Miller_1_faces.jpg']
```

```
groups[12]

['../closestFaces/Kate_Winslet_1_faces.jpg',
 '../closestFaces/Kate_Winslet_0_faces.jpg',
 '../closestFaces/Kate_Winslet_5_faces.jpg']
```

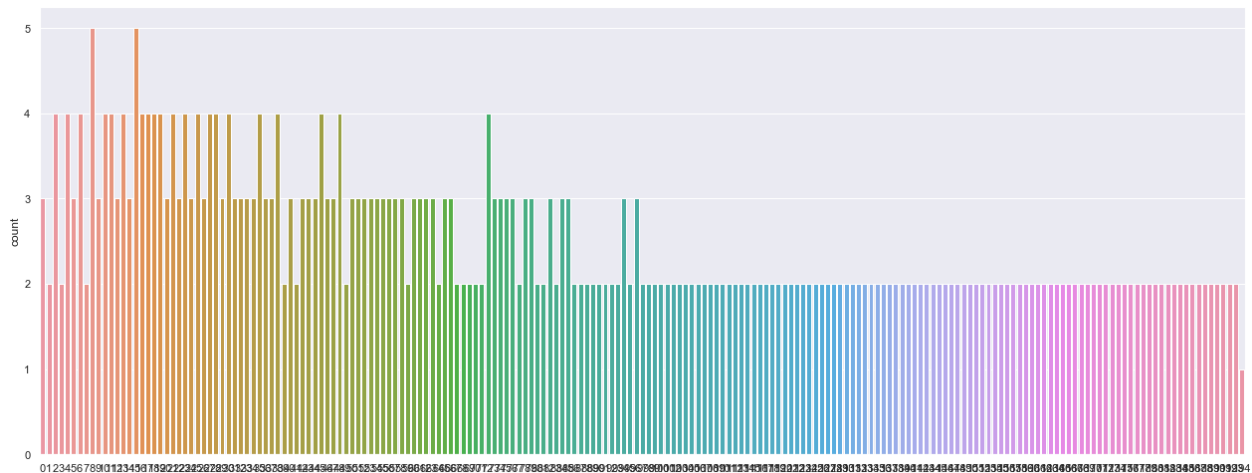
```
groups[134]

['../closestFaces/Marc_Shaiman_3_faces.jpg',
 '../closestFaces/Marc_Shaiman_1_faces.jpg']
```

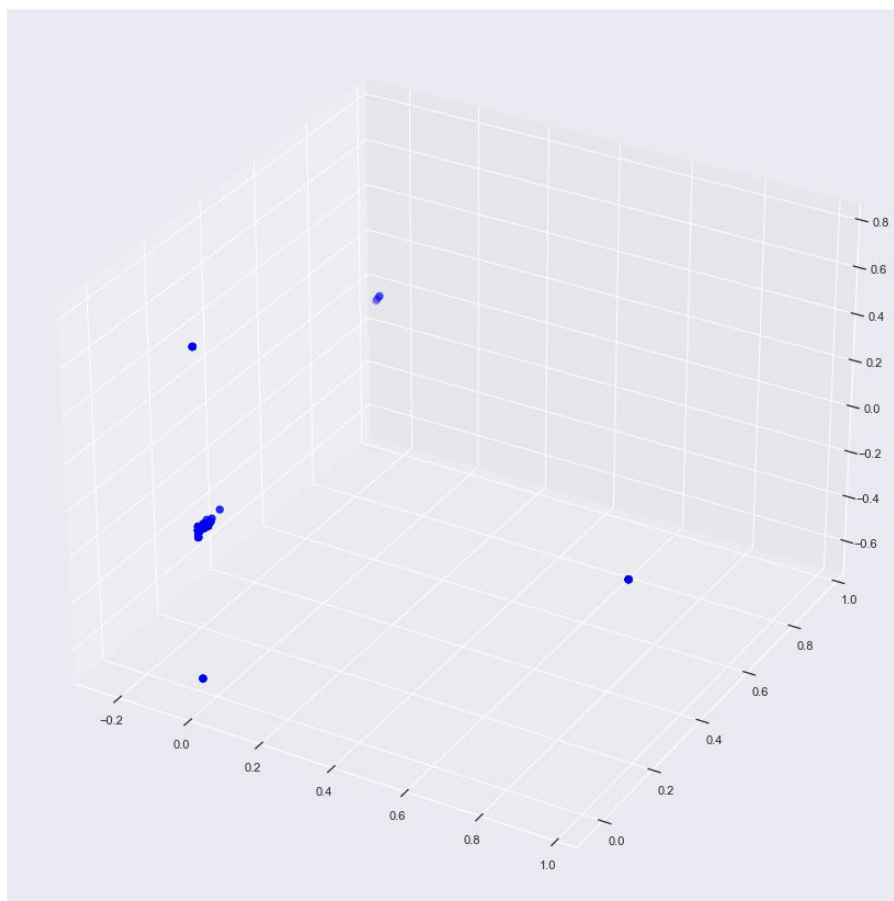
Priklady clusterov

```
[186 186 25 25 36 36 70 70 69 69 9 9 9 103 103 110 110 2
 2 2 152 152 146 146 61 61 18 18 192 192 20 20 133 133 78 78
 7 7 7 0 0 184 184 45 45 45 132 132 13 13 13 161 161 35
35 35 170 170 97 97 124 124 46 46 46 179 179 55 55 43 43 134
134 6 6 6 30 30 30 145 145 10 10 80 80 123 123 81 81 11
11 11 8 8 8 162 162 154 154 115 115 48 48 48 74 74 108 108
91 91 106 106 58 58 180 180 193 193 117 117 175 175 23 23 64 64
89 89 126 126 93 93 28 28 28 156 156 113 113 129 129 135 135 15
15 60 60 60 44 44 44 62 62 112 112 14 14 14 51 51 51 27
27 166 166 172 172 77 77 165 165 59 59 59 160 160 32 32 32 153
153 52 52 174 174 49 49 140 140 96 96 34 34 34 66 66 66 37
37 54 54 84 84 150 150 38 38 116 116 72 72 50 50 109 109 139
139 12 12 12 83 83 148 148 131 131 100 100 114 114 85 85 144 144
82 82 82 151 151 137 137 39 39 39 56 56 56 159 159 101 101 155
155 76 76 67 67 141 141 57 57 16 16 16 130 130 190 190 94 94
26 26 87 87 164 164 86 86 178 178 125 125 63 63 120 120 105 105
95 95 173 173 127 127 168 168 149 149 98 98 21 21 21 147 147 188
188 42 42 42 5 5 5 79 79 79 104 104 99 99 121 121 167 167
75 75 75 171 171 41 41 41 29 29 3 3 3 169 169 157 157 128
128 158 158 88 88 90 90 68 68 177 177 111 111 143 143 107 107 24
24 24 182 182 17 17 17 73 73 136 136 31 31 183 183 122 122 4
4 40 40 40 185 185 22 22 142 142 65 65 102 102 47 47 47 33
33 33 92 92 138 138 119 119 53 53 53 187 187 191 191 176 176 71
71 71 181 181 163 163 189 189 118 118 19 19 19 1 1 11 8 55
22 57 9 54 69 46 15 76 42 38 27 30 84 33 31 21 26 36
28 24 7 17 17 72 5 33 67 86 14 39 23 43 93 194 19 35
64 78 74 34 63 12 29 13 70 49 0 32 4 114 2 3 10]
```

Rozdelenie fotiek do clusterov



Koľko obrázkov sa nachádza v ktorom clustri



1Samotné 3D zobrazenie vyhadzovalo hlúposti a už som nemal chuť ani čas to riešiť