A
Seminar
On

WORKING BEHIND SNAPCHAT FILTERS

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OUTLINES

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2. Introduction
3. Computer vision
4. Pixelation
5. Pixel data
6. Face Detection
7. Locating facial features (active face model)
8. All three
9. Viola jones algorithm
10. Haar- like features
11. Darkness algo with Integral Image
12. Adaboost
13. Cascading Classifiers
14. References

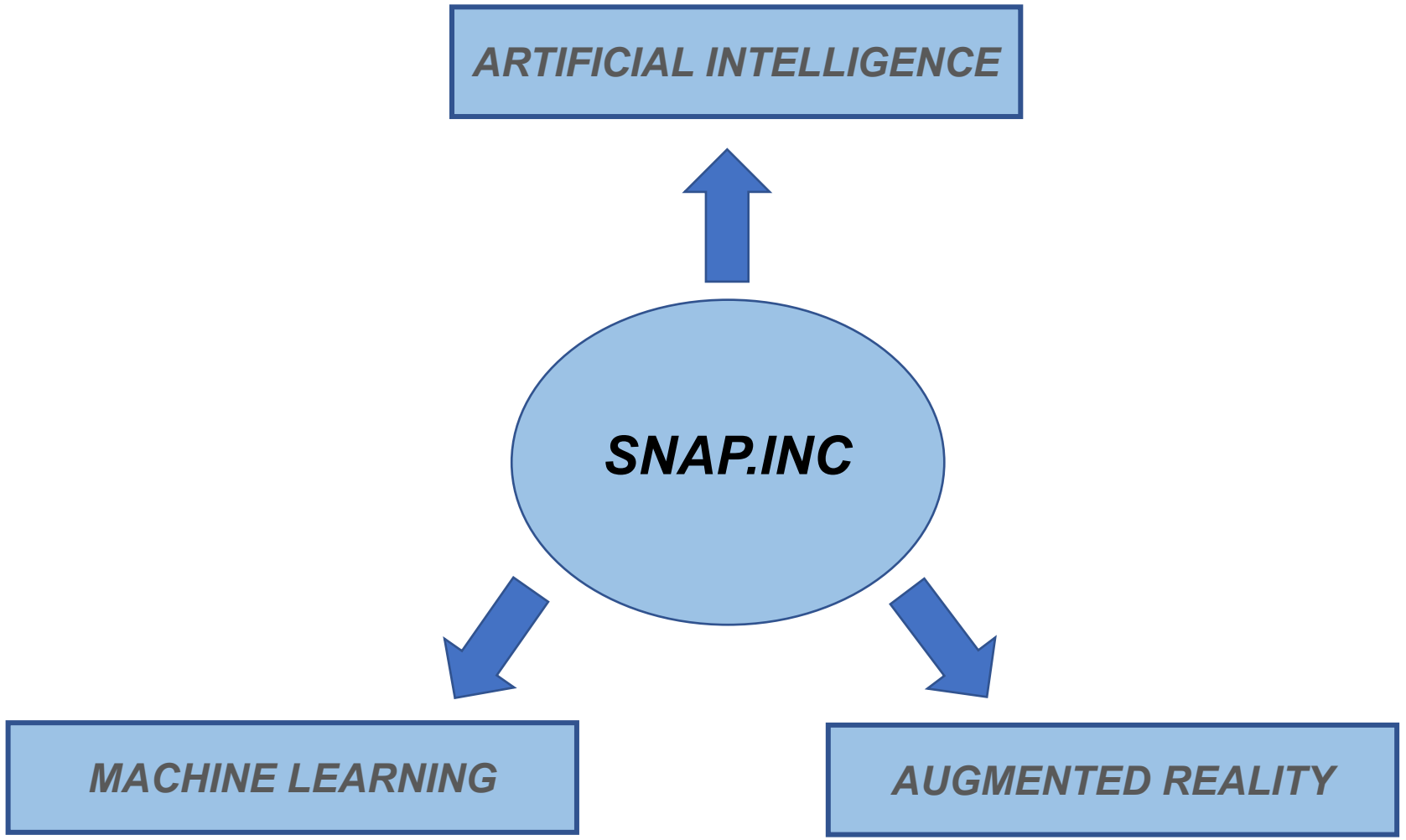
HISTORY

A Ukrainian company , LOOKSERY

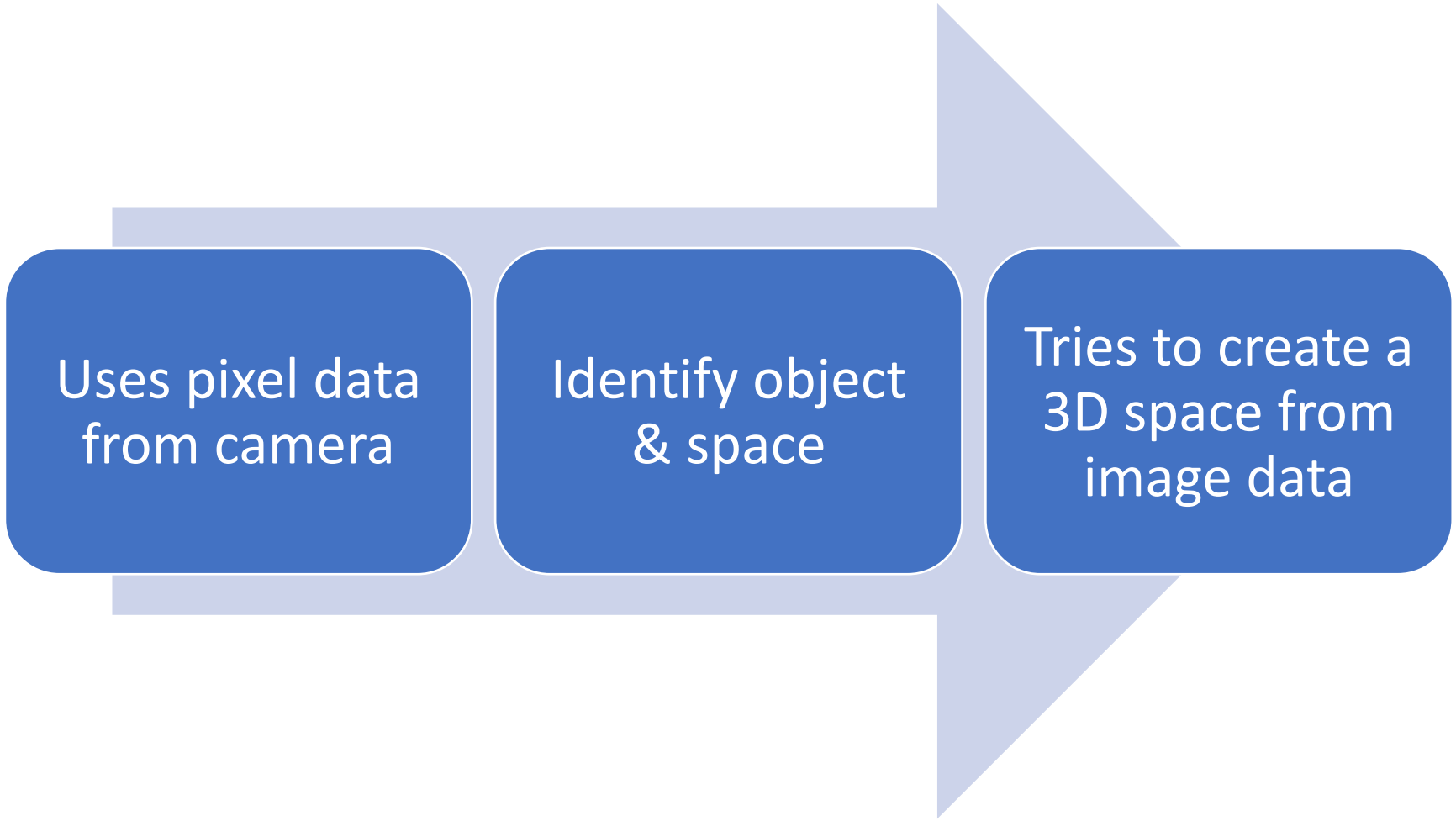
Snapchat acquired LOOKSERY

Snapchat introduces 'Discover' and 'Lenses'

INTRODUCTION

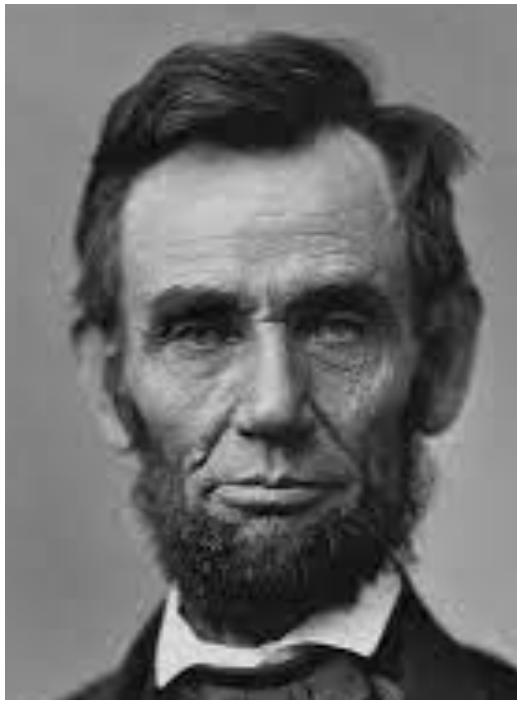


COMPUTER VISION



Computer vision is all about pattern recognition

PIXELATION



Abraham Lincoln

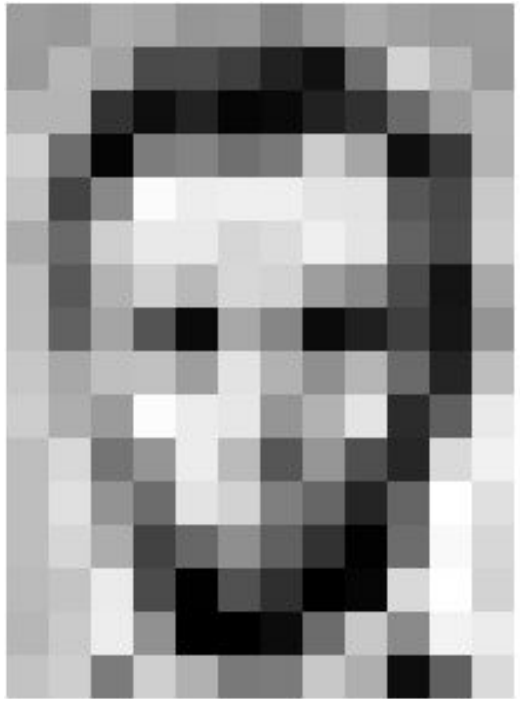
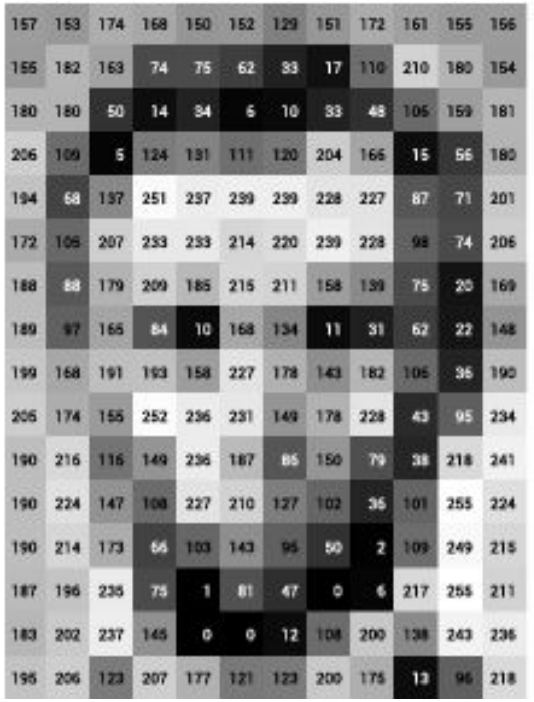


Image resolution changed



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

Pixelated Abraham Lincoln

157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

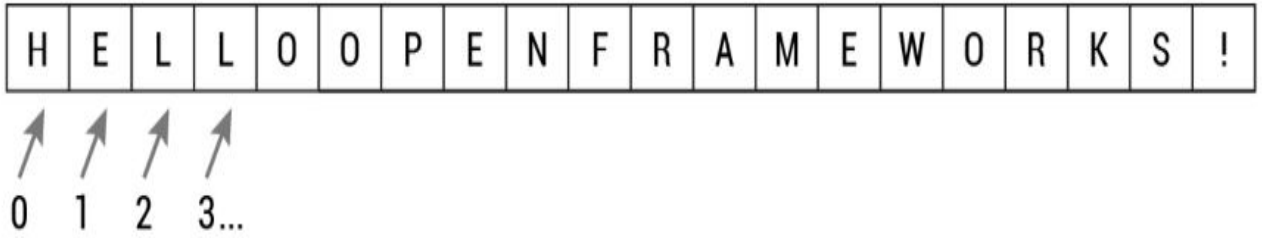
Abraham Lincoln's image in numerated form

PIXEL DATA

How the pixels are numbered:

0	1	2	3	4
5	6	7	8	9
10	11	12	13	14
15	16	17	18	19

How the pixels are stored in computer memory:



Perceived as 2-D storage but its actual a linear storage in computer's memory

FACE DETECTION

157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
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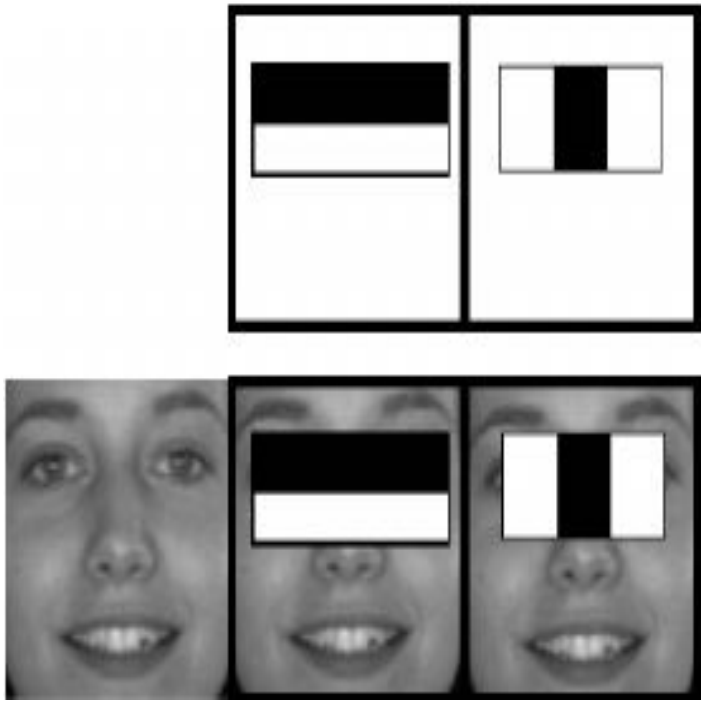
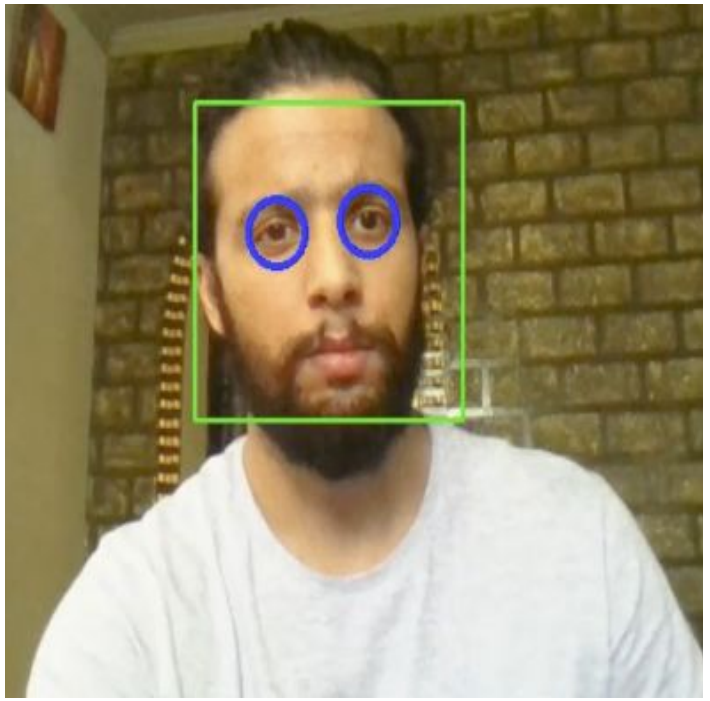
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

Image Data



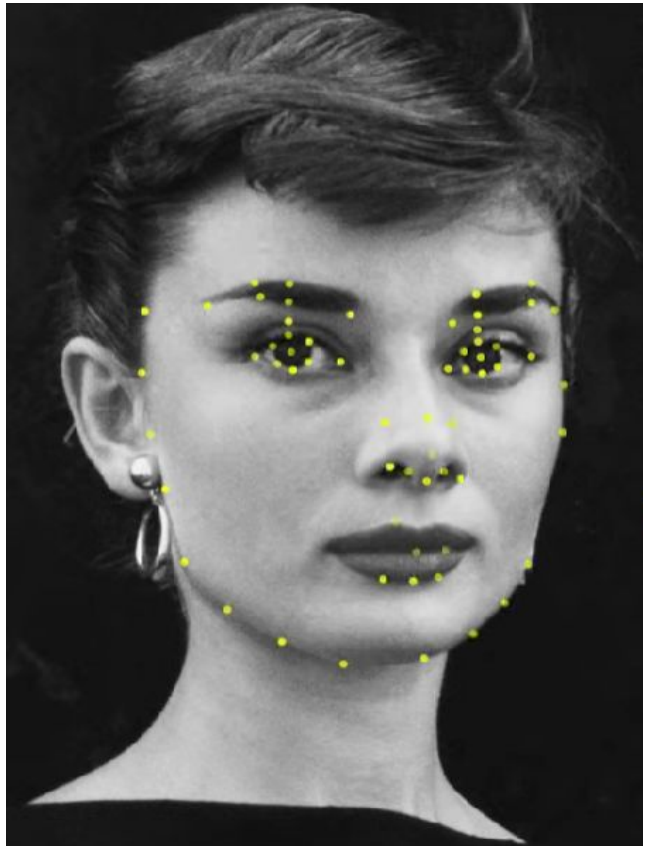
Light and dark parts of a grayscaled image



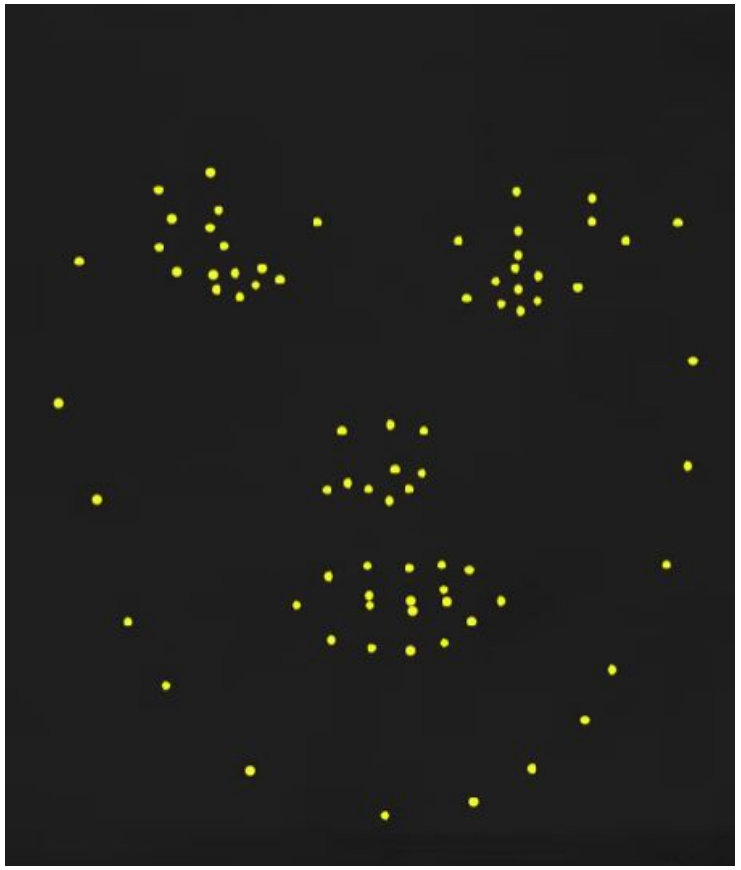
Facial detection algorithm known as Viola-Jones Algorithm

LOCATING FACIAL FEATURES

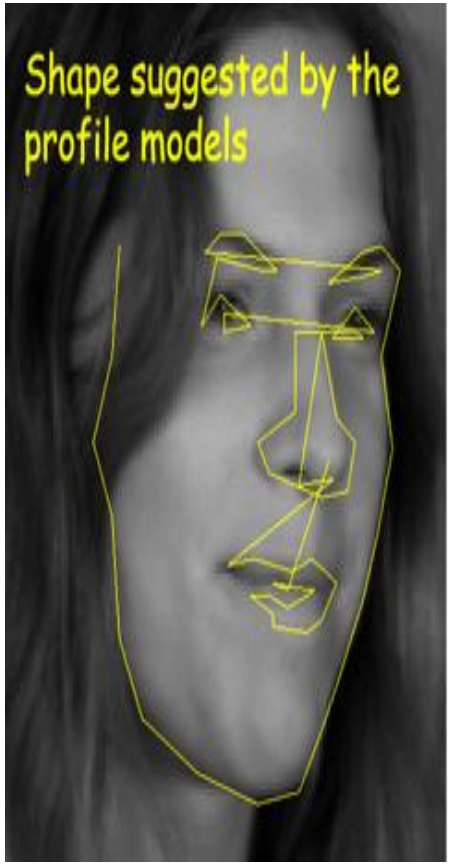
ACTIVE FACE MODEL

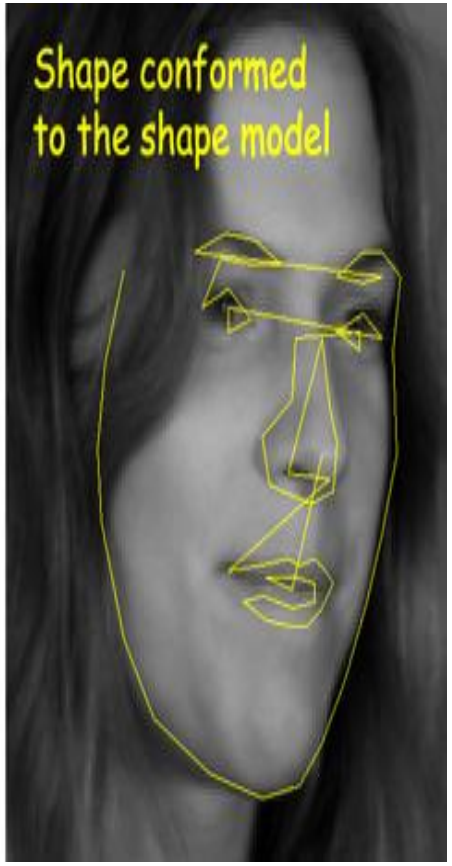


Manually mark boundaries



Average face from trained data

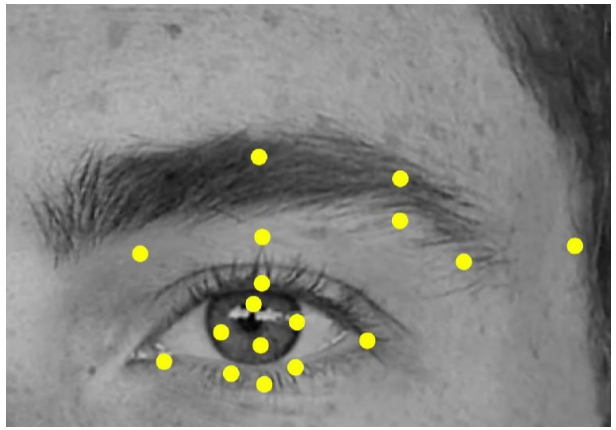


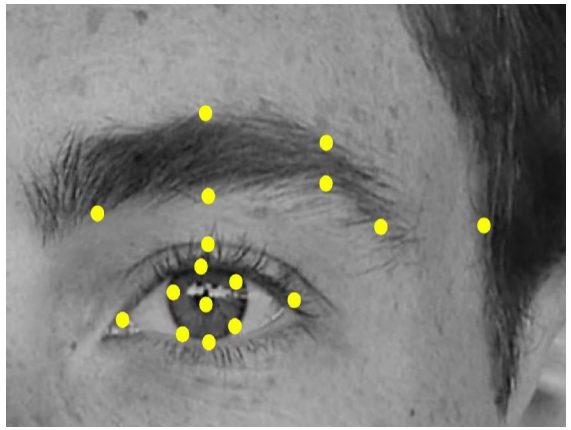


Trained data aligned with facial features

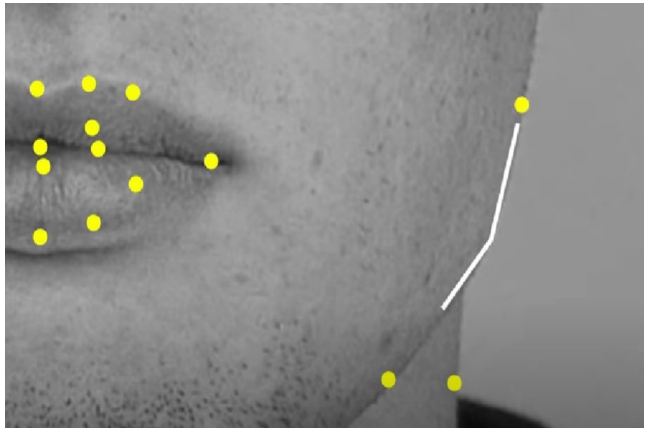
ALL THREE

- Analyzing PIXEL DATA
- GRAYSCALE
- COORDINATE CREATION

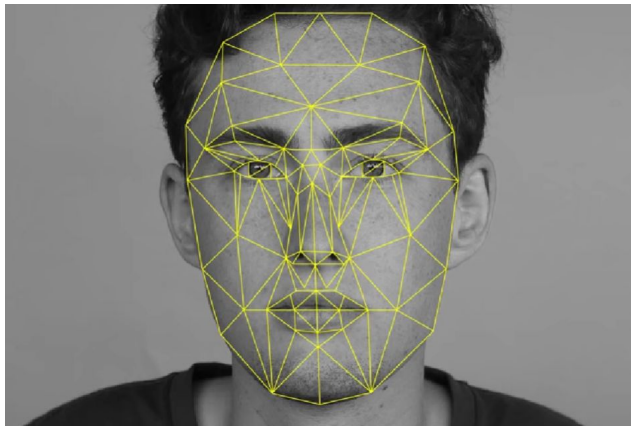




Scaling, rotating and resizing to create boundaries to locate facial features



Dots joining to form an edge



Edges join to form a mesh-like structure

VIOLA JONES ALGORITHM

- algorithm works on grayscale image
- algorithm looks at smaller subregions
- tries to find a face by looking for specific features
- check different positions and scales
- uses Haar-like features to detect faces
- 2 features: Training and Detection.

HAAR-LIKE FEATURES

Digital image features in obj. recognition

Faces share universal features i.e. ***eyes region is darker than nose region***.

Two features

Edge-like features

Line-like features

Edge-like features

One dark & one light

Line-like features

Dark region btw light region

DARKNESS ALGO / INTEGRAL IMAGE

Finding average darkness 'A'

Finding sum of pixels above and left side of each square, creating new image.

Find percentage darkness & lightness

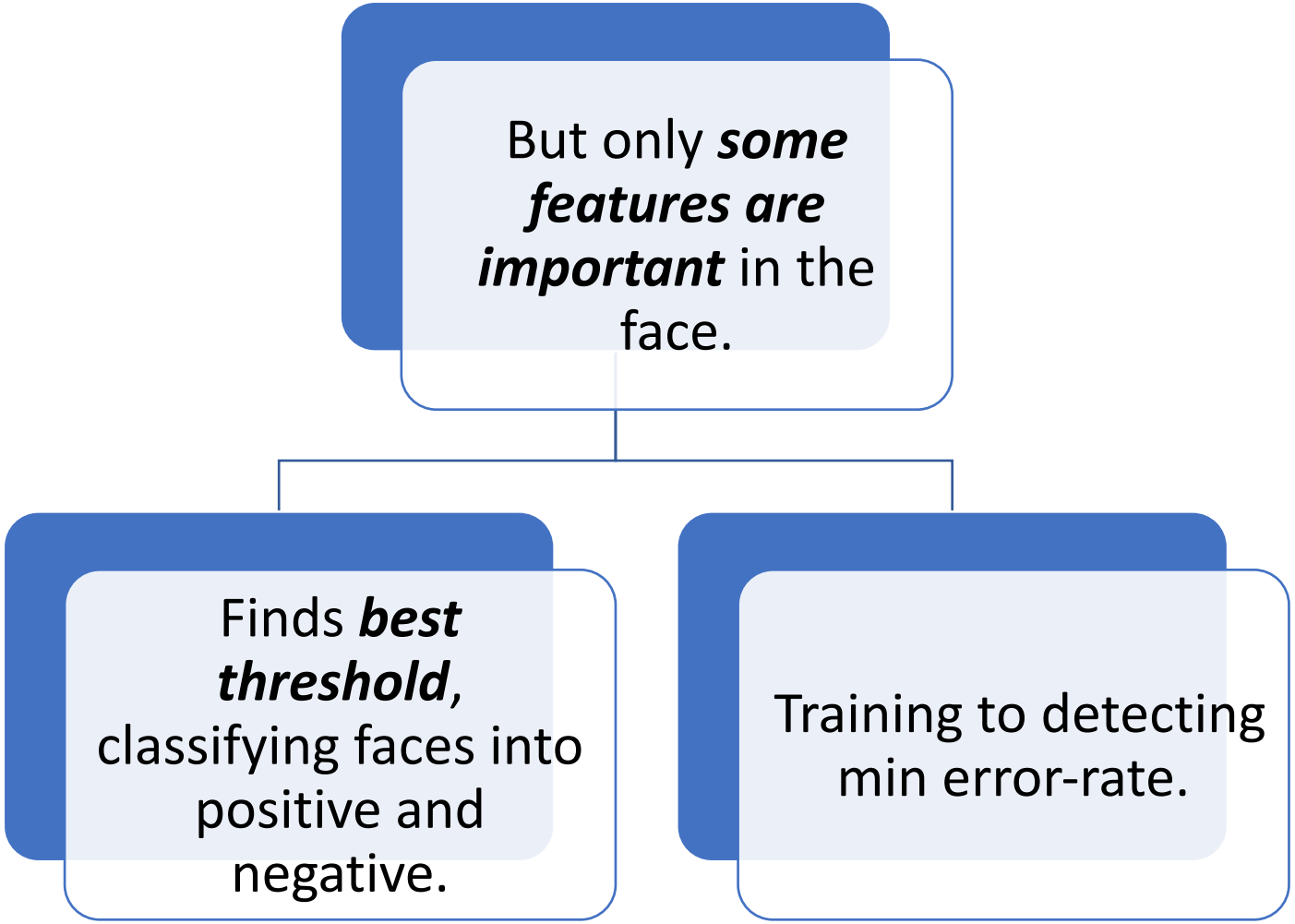
Original Image

0	1	3	5	2	7	10	7	10	9
3	7	6	9	3	8	1	8	5	8
1	11	0	7	13	2	14	2	13	1
14	3	2	7	1	0	9	7	2	12
1	5	15	3	6	6	5	1	10	6
8	1	2	6	7	3	2	11	0	15
7	7	6	0	9	5	10	3	8	1
12	5	6	10	11	3	6	7	9	1

Integral Image

		51							

ADABOOST


But only ***some features are important*** in the face.
Finds ***best threshold***, classifying faces into positive and negative.
Training to detecting min error-rate.

CASCADING CLASSIFIERS

Cascading quickly discard non-faces and avoid wasting time.

- Setting-up cascading system

Step-I : Passed through best features

Step-II : Face evaluated; +ve -next stage , -ve - discarded

All steps cleared then human face detected

REFERENCES

- Computer vision
https://towardsdatascience.com/everything-you-ever-wanted-to-know-about-computer-vision-heres-a-look-why-it-s-so-awesome-e8a58dfb641e
- Active shape model
https://link.springer.com/chapter/10.1007/978-3-642-54851-2_1#:~:text=Active%20Shape%20Model%20(ASM)%20is,ASM%20to%20the%20face%20recognition
- Facial detection
https://medium.com/analytics-vidhya/creating-snapchat-like-filters-from-scratch-using-computer-vision-techniques-6374cde6a7db
- Viola-Jones Algorithm
https://www.mygreatlearning.com/blog/viola-jones-algorithm/#sh1
- Adaboost
https://hub.packtpub.com/implementing-face-detection-using-haar-cascades-adaboost-algorithm/
- Cascading Classifiers
https://www.sciencedirect.com/topics/computer-science/classifier-cascade

THANK YOU