

1906004102015

Bilgisayarlı Görme

BAİBÜ 2023 - 24 Bahar

İsmail Hakkı Parlak

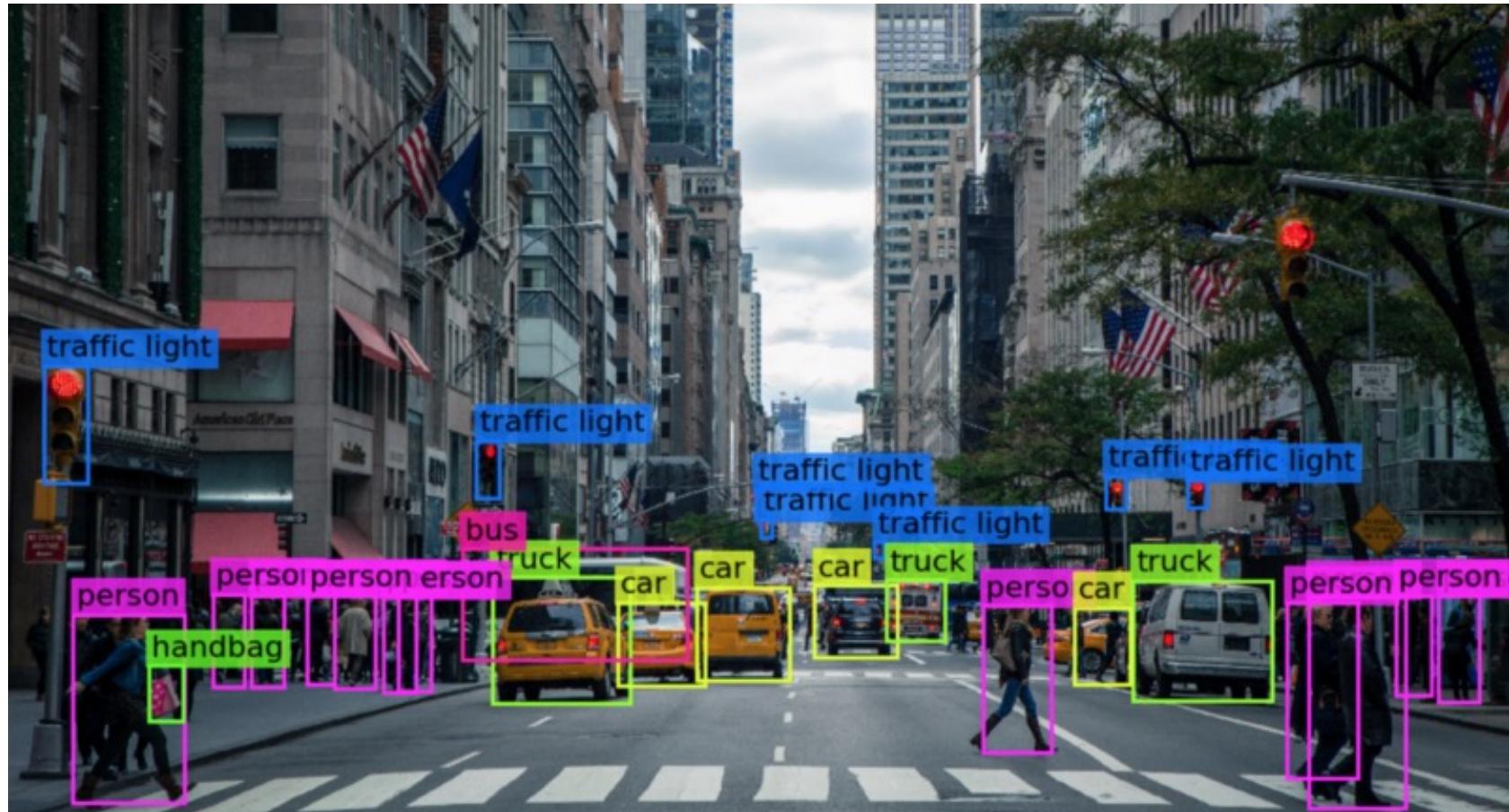
ismail.parlak@ibu.edu.tr

Oda: 335

Ders Bilgileri

- Vize %30 + Final %70
- Python, lineer cebir, kalkülüs
- Kaynaklar
 - «Computer Vision: Algorithms and Applications» - Richard Szeliski (<https://szeliski.org/Book/>)
 - «Computer Vision: Foundations and Applications» - Ranjay Krishna
 - https://github.com/ihpar/ibu_cv

BG (CV) Uygulamaları



Mihajlovic, towardsdatascience

BG (CV) Uygulamalari



Rizzoli, v7labs

BG (CV) Uygulamalari



BG (CV) Uygulamalari



Rizzoli, v7labs

BG (CV) Uygulamaları



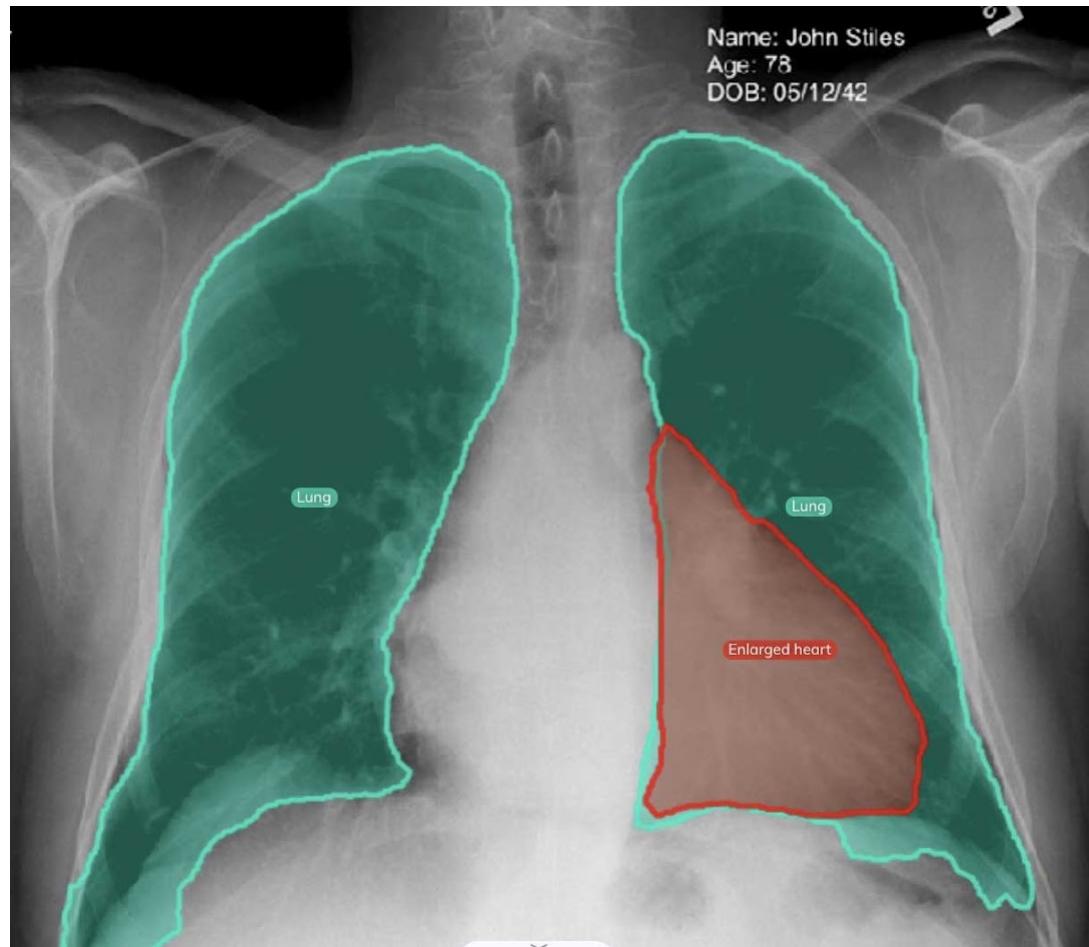
Rizzoli, v7labs

BG (CV) Uygulamalari



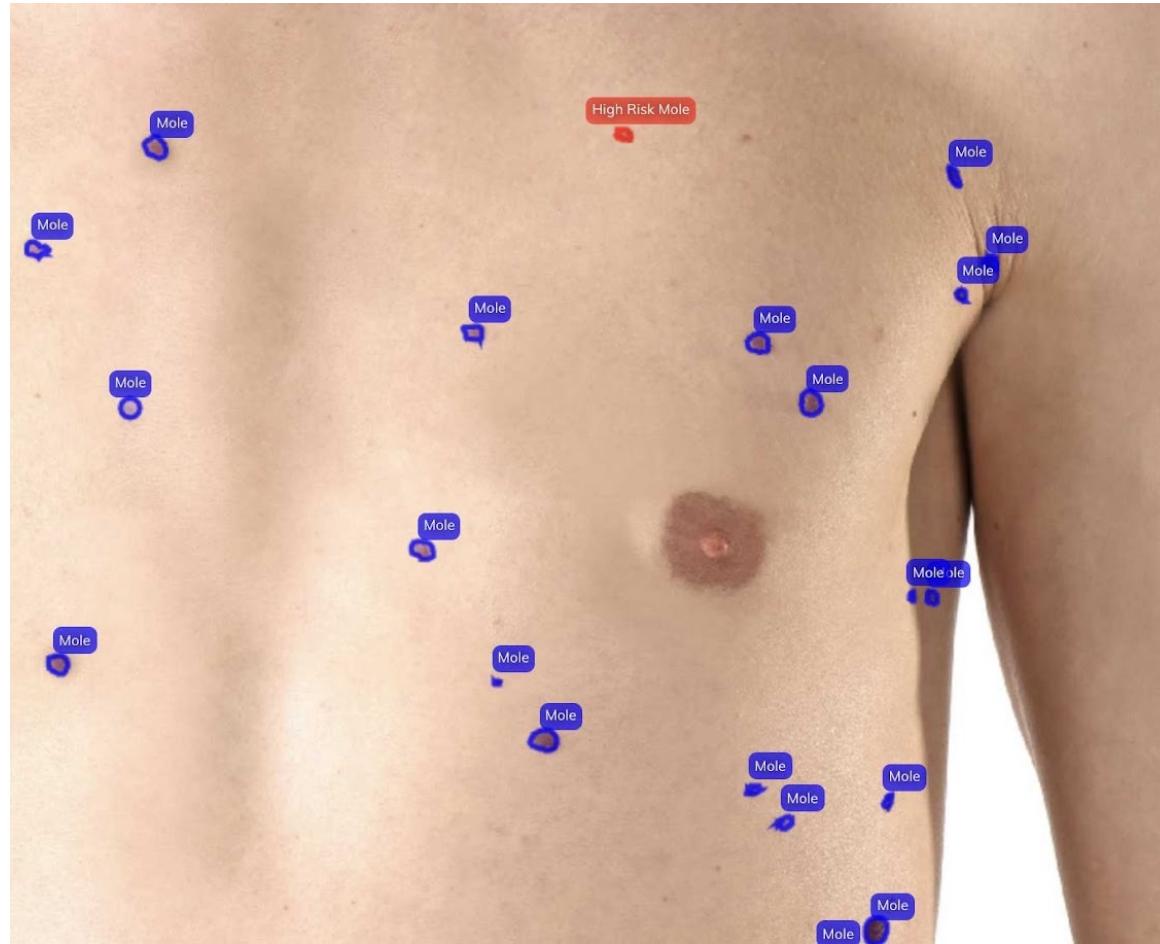
Rizzoli, v7labs

BG (CV) Uygulamalari



Rizzoli, v7labs

BG (CV) Uygulamaları



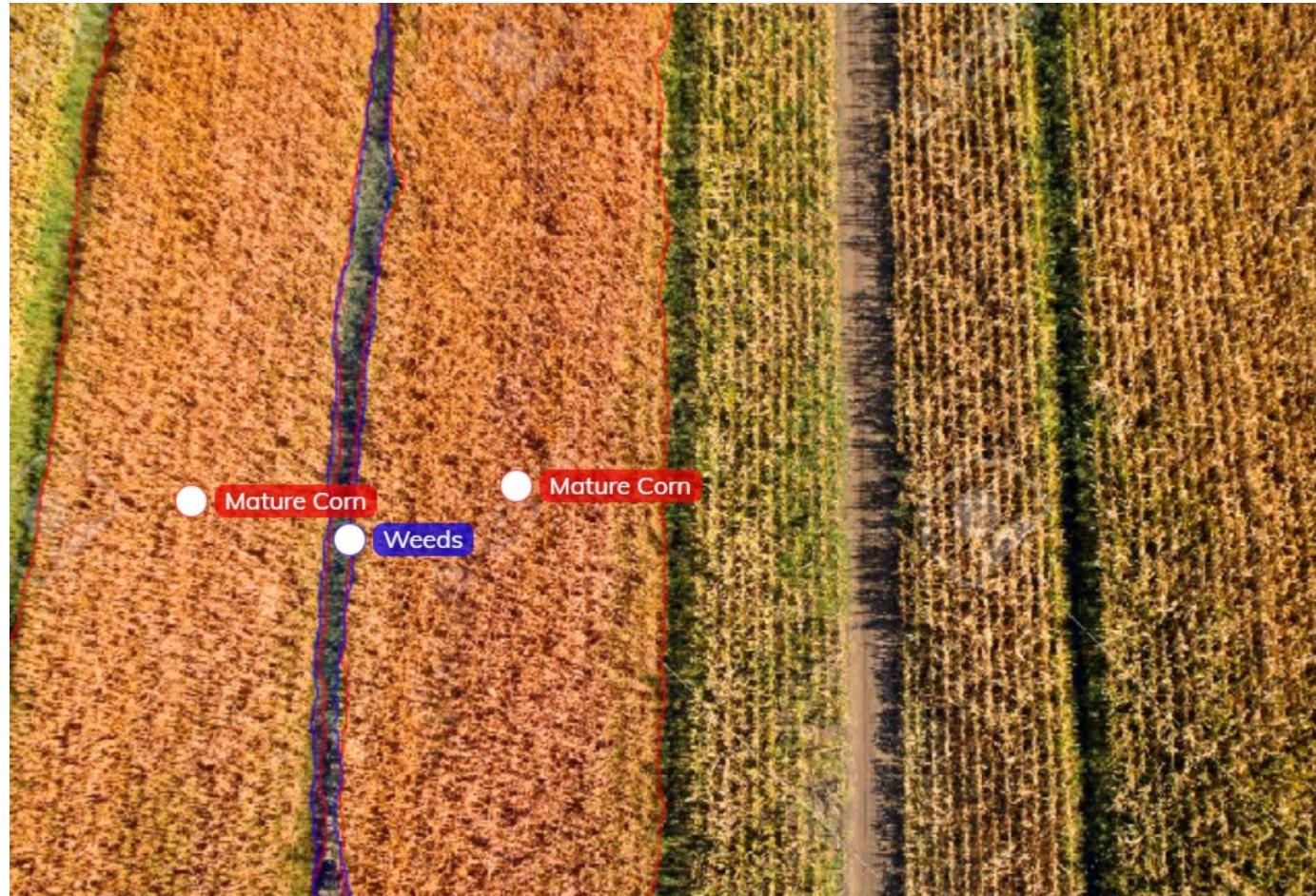
Rizzoli, v7labs

BG (CV) Uygulamalari



Rizzoli, v7labs

BG (CV) Uygulamalari



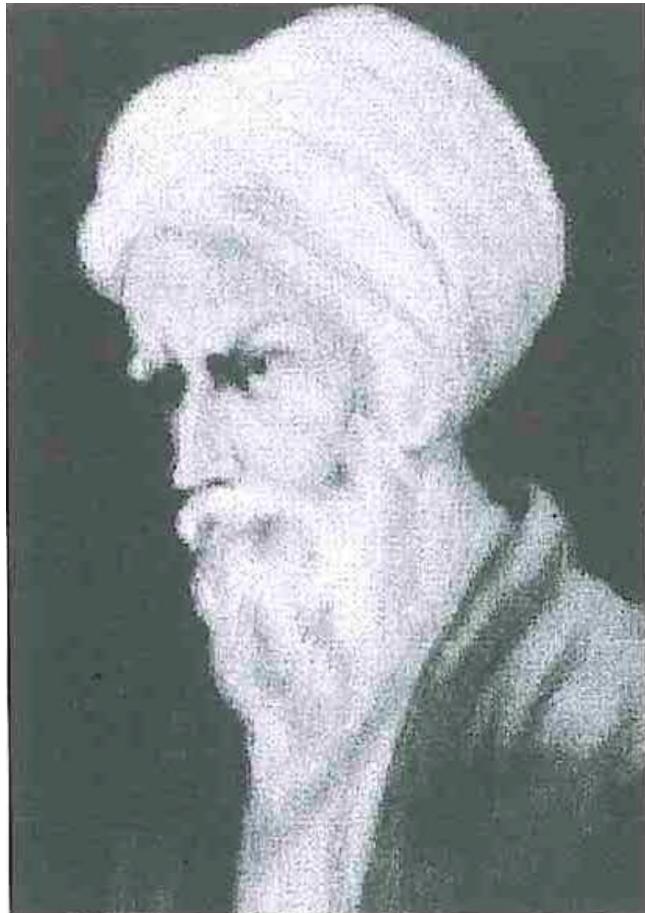
Rizzoli, v7labs

BG (CV) Uygulamaları



**"a zebra standing in
a field of grass"**

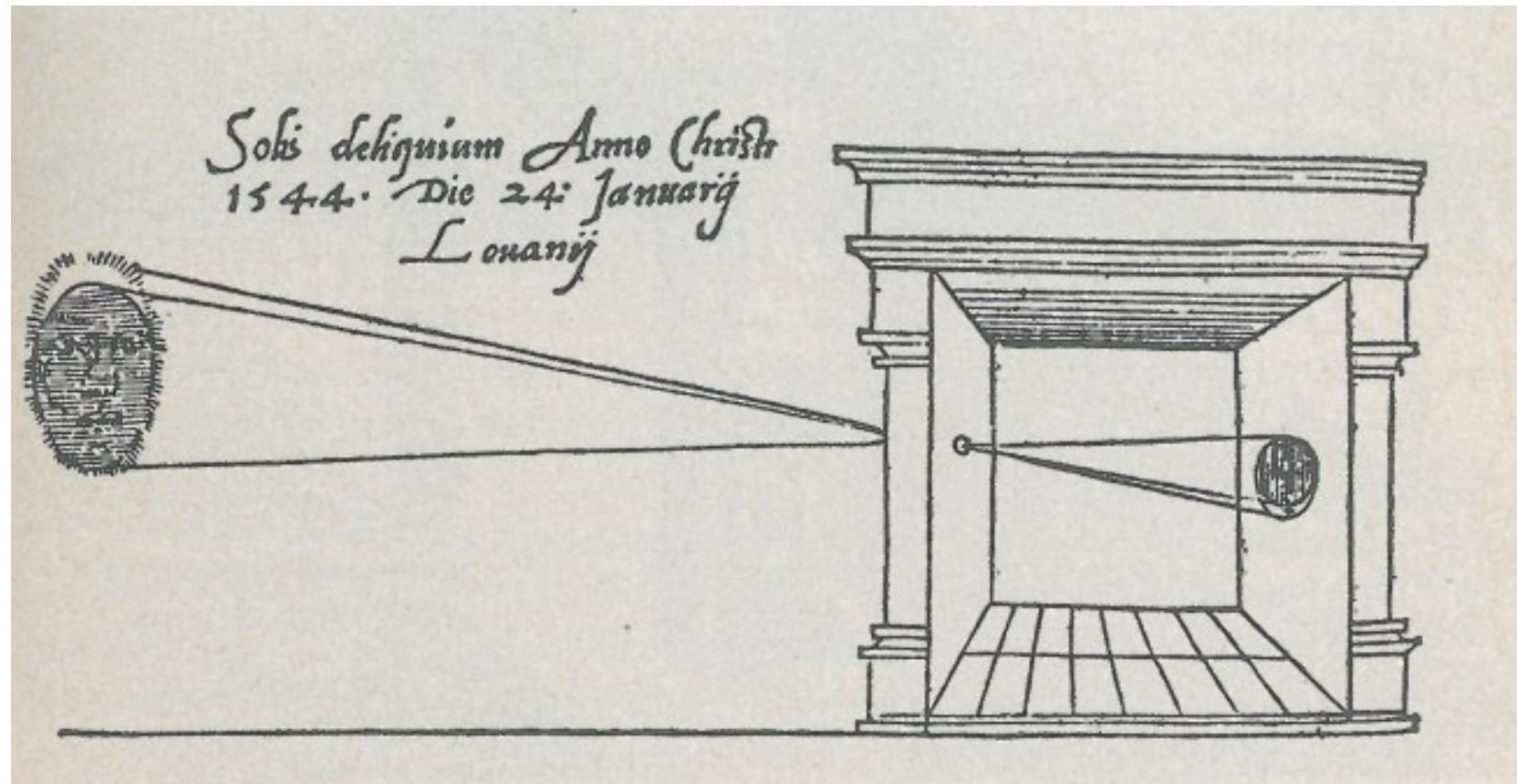
Görme



İbnü'l Heysem (1040)

"Gözişin Kuramı'na göre **gözden** ışık çıkmakta, nesneye ulaşabilmesi için saydam ortamdan geçerek görme eylemi gerçekleşmektedir. Oysa bütün ihtimaller dikkate alındığında, gözden ışığın çıkışıyla değil, göz işinlarının bakılan nesneye gidip ondan geri gelmesiyle görme gerçekleşir."

Camera Obscura (Karanlık Oda)

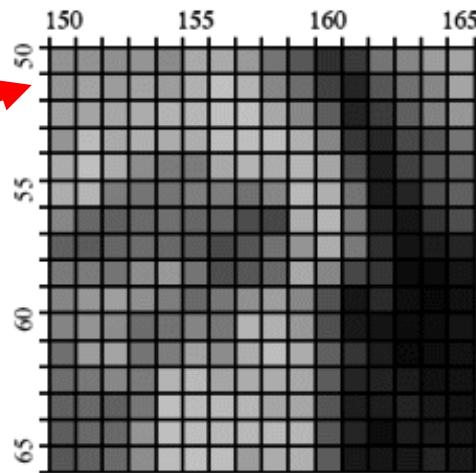
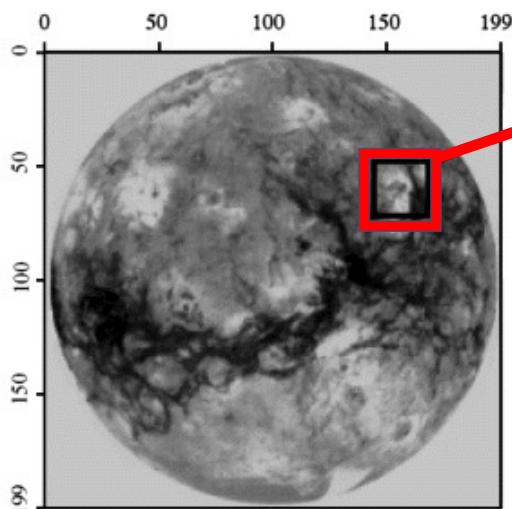


De Radio Astronomica et Geometrica, Gemma Frisius, 1545

Görü ve Bilgisayarlı Görme

- **Görü:** Nesnelerden yansıyan elektromanyetik dalgaların algılanması ve anlamlanırılması ile oluşturulan yaklaşık çevre modeli (Vural, ODTÜ).
- **Bilgisayarlı Görme (Bilgisayarlı Görü, Computer Vision - CV):** İnsan görme sisteminin karmaşıklığının parçalarını kopyalamaya ve bilgisayarların, insanların yaptığı gibi görüntü ve videolardaki nesneleri tanımlayıp işlemesine odaklanan bilgisayar bilimi alanıdır (IBM).

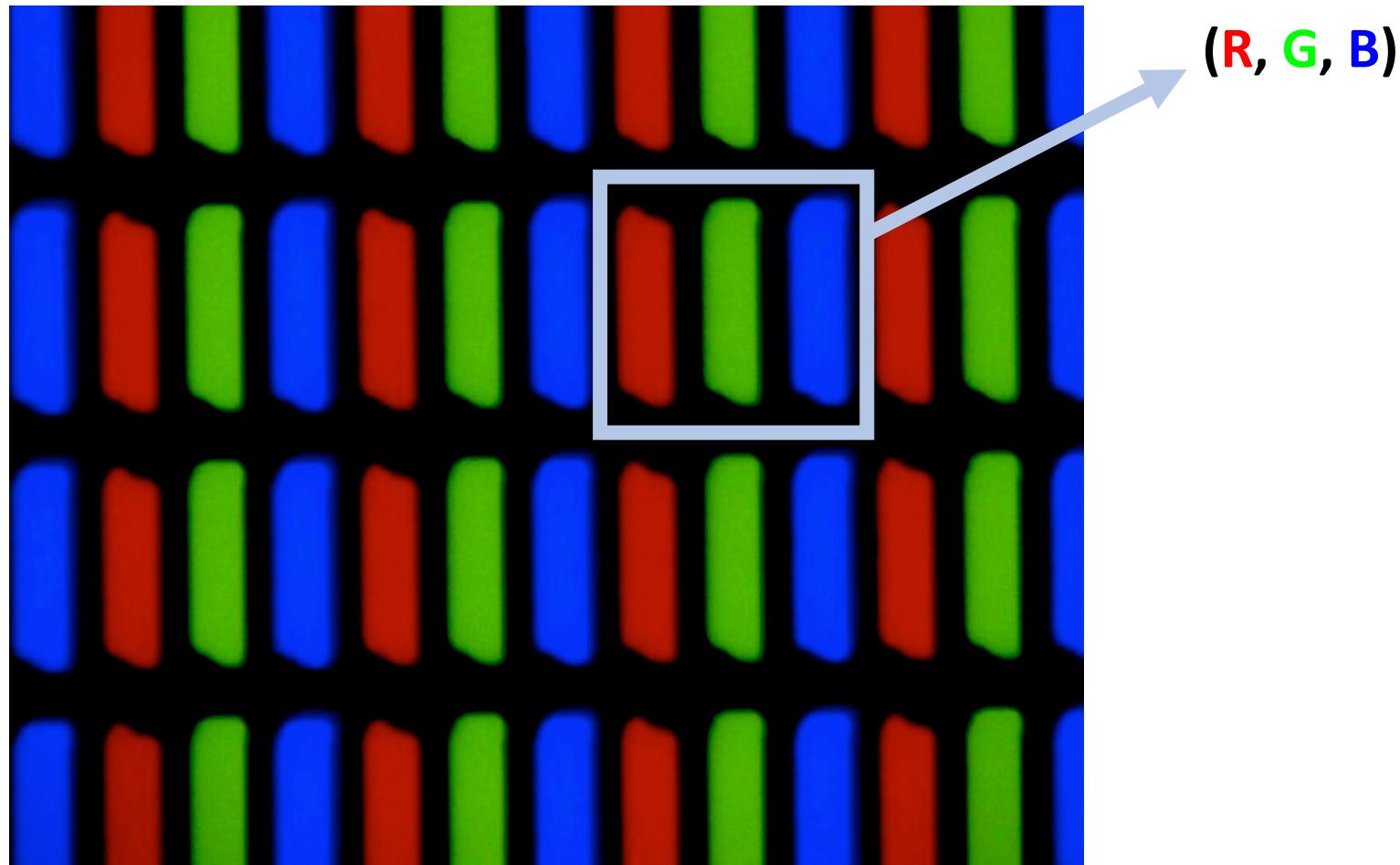
Dijital Resim



A 16x16 grid of numerical values. The columns are labeled at the top with values 150, 155, 160, and 165. The rows are labeled on the left with values 50, 55, 60, and 65. Red arrows point from the grid to the corresponding values in the table.

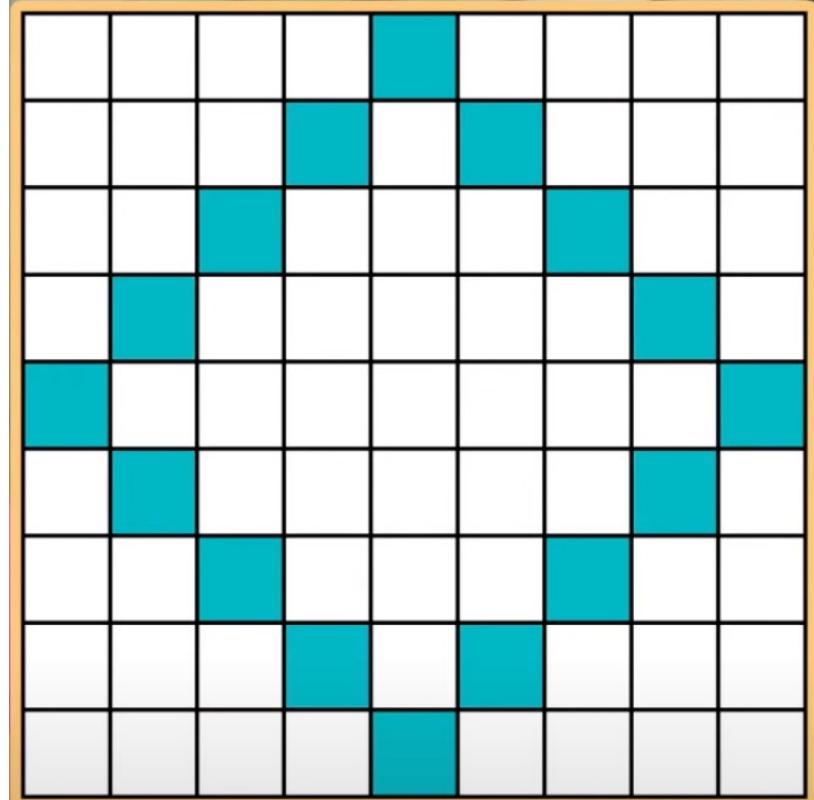
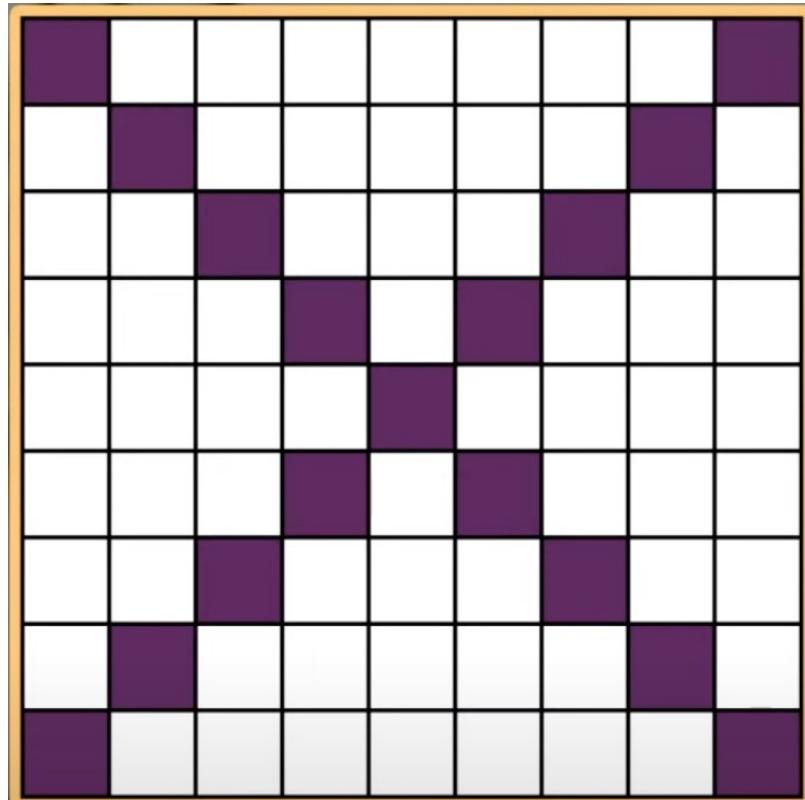
183	183	181	184	177	200	200	189	159	135	94	105	160	174	191	196
186	195	190	195	191	205	216	206	174	153	112	80	134	157	174	196
194	196	198	201	206	209	215	216	199	175	140	77	106	142	170	186
184	212	200	204	201	202	214	214	214	205	173	102	84	120	134	159
202	215	203	179	165	165	199	207	202	208	197	129	73	112	131	146
203	208	166	159	160	168	166	157	174	211	204	158	69	79	127	143
174	149	143	151	156	148	146	123	118	203	208	162	81	58	101	125
143	137	147	153	150	140	121	133	157	184	203	164	94	56	66	80
164	165	159	179	188	159	126	134	150	199	174	119	100	41	41	58
173	187	193	181	167	151	162	182	192	175	129	60	88	47	37	50
172	184	179	153	158	172	163	207	205	188	127	63	56	43	42	55
156	191	196	159	167	195	178	203	214	201	143	101	69	38	44	52
154	163	175	165	207	211	197	201	201	199	138	79	76	67	51	53
144	150	143	162	215	212	211	209	197	198	133	71	69	77	63	53
140	151	150	185	215	214	210	210	211	209	135	80	45	69	66	60
135	143	151	179	213	216	214	191	201	205	138	61	59	61	77	63

Dijital Resim

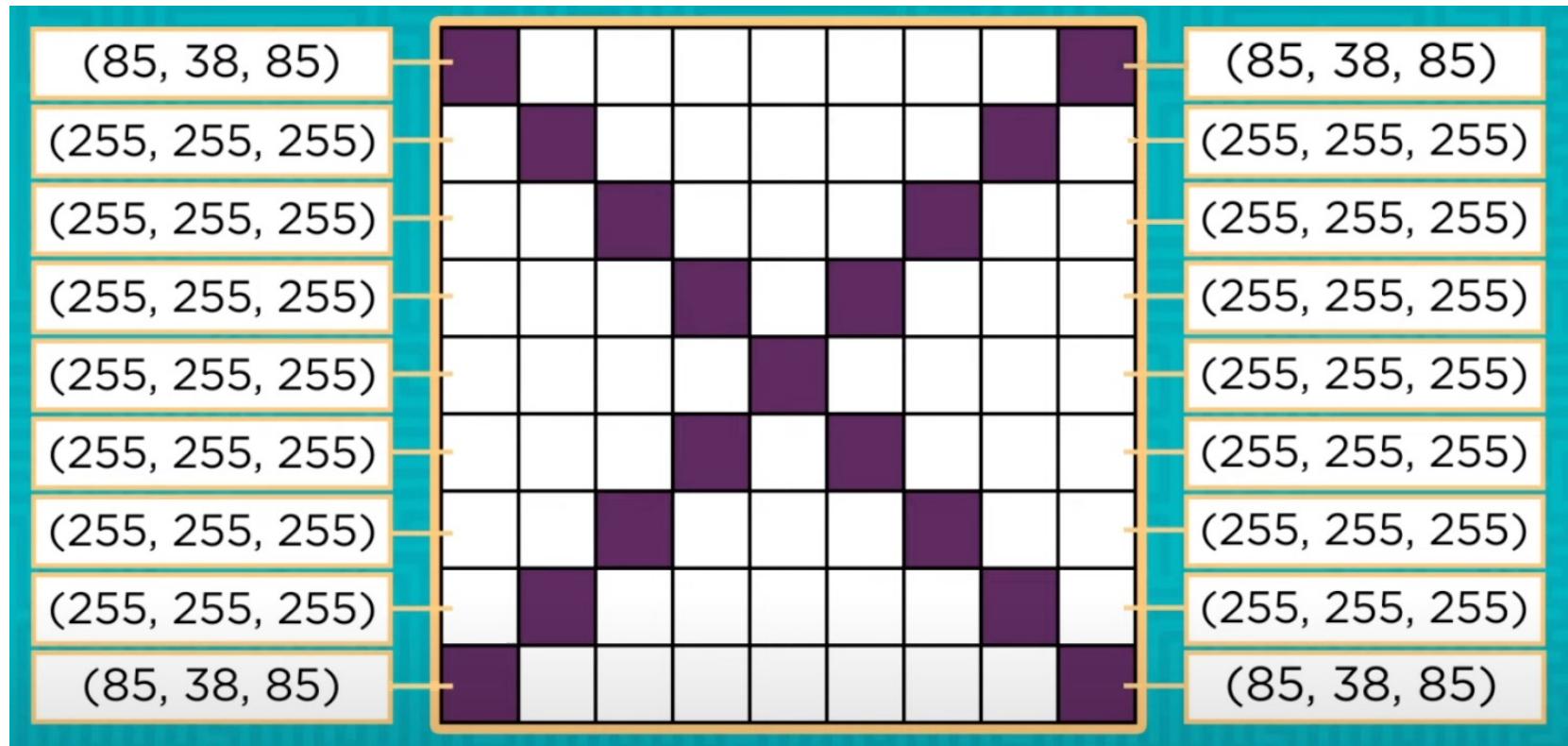


commons.wikimedia.org

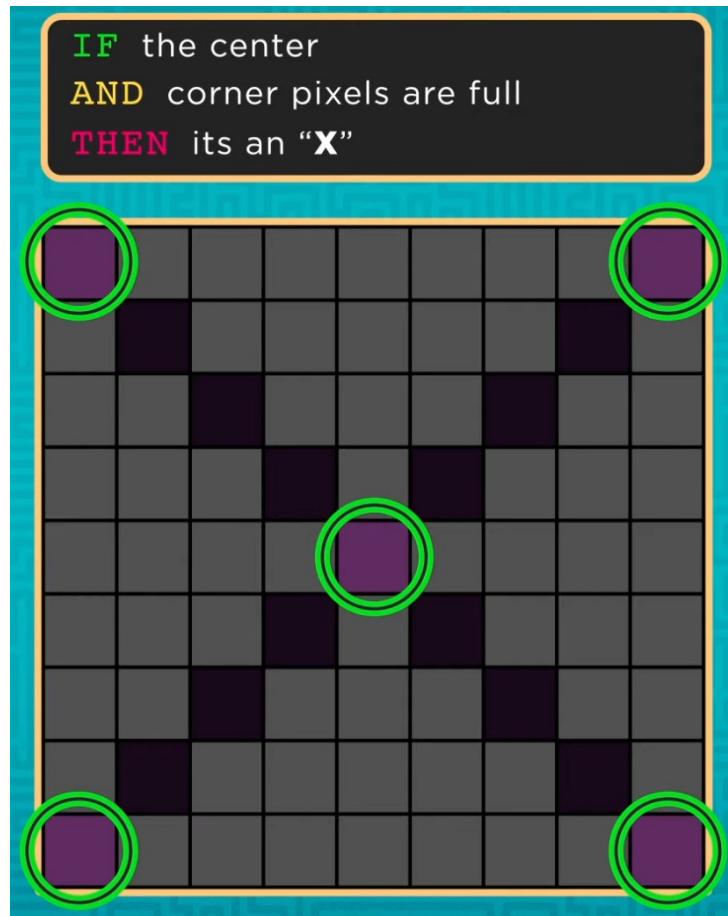
Karakter Tanıma



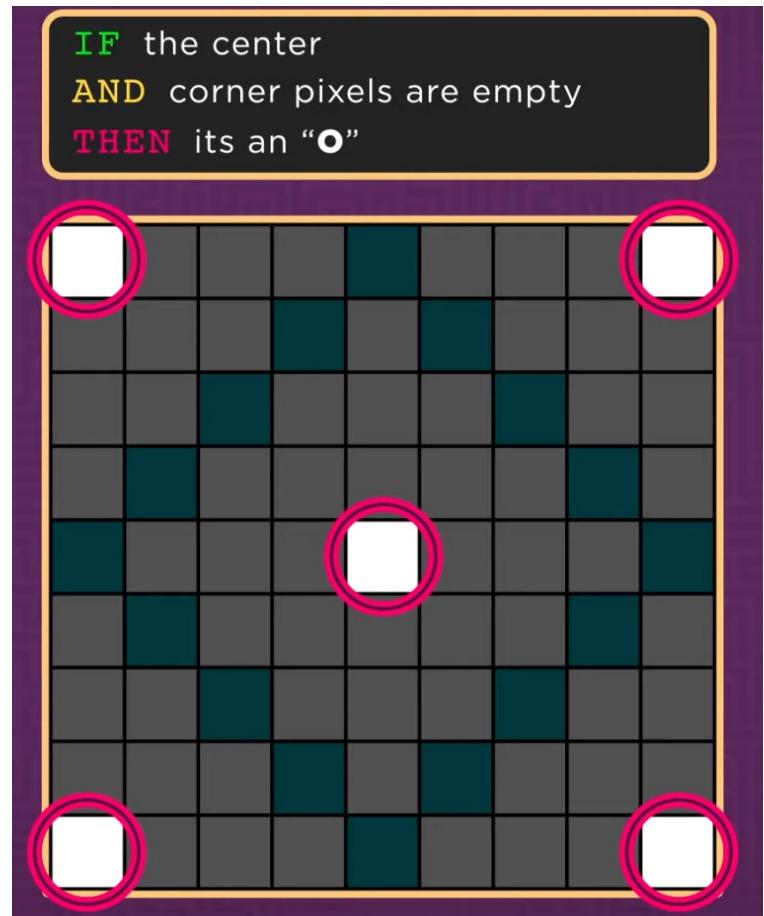
Karakter Tanima



Karakter Tanim



code.org



Karakter Tanima

IF the center AND corner pixels are full THEN its an “X”

The image shows four 8x8 pixel grids. Each grid has a central green circle and four corner circles. The first grid contains purple pixels. The second grid contains cyan pixels. The third grid contains teal pixels. The fourth grid contains red pixels. The corners of each grid are marked with pink circles.

Zorluklar - Aydınlatma



Fridman, MIT

Zorluklar - Pozlama



Zorluklar - Sınıf içi Çeşitlilik



Fridman, MIT

Zorluklar - Engeller



Fridman, MIT

Zorluklar - Anlamsal Karmaşa



Fridman, MIT

Zorluklar - Arka Plan



Duygulu, Bilkent

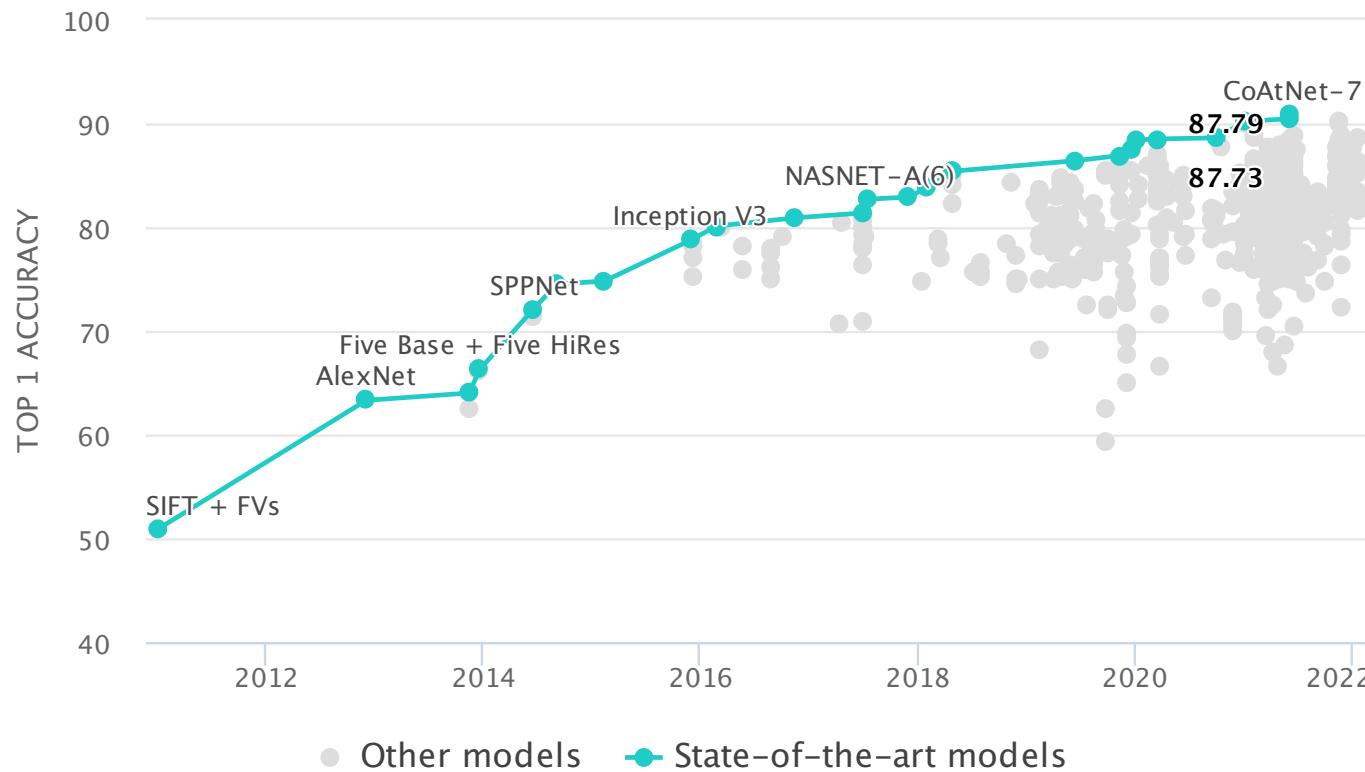
Zorluklar - Hareketlilik



Duygulu, Bilkent

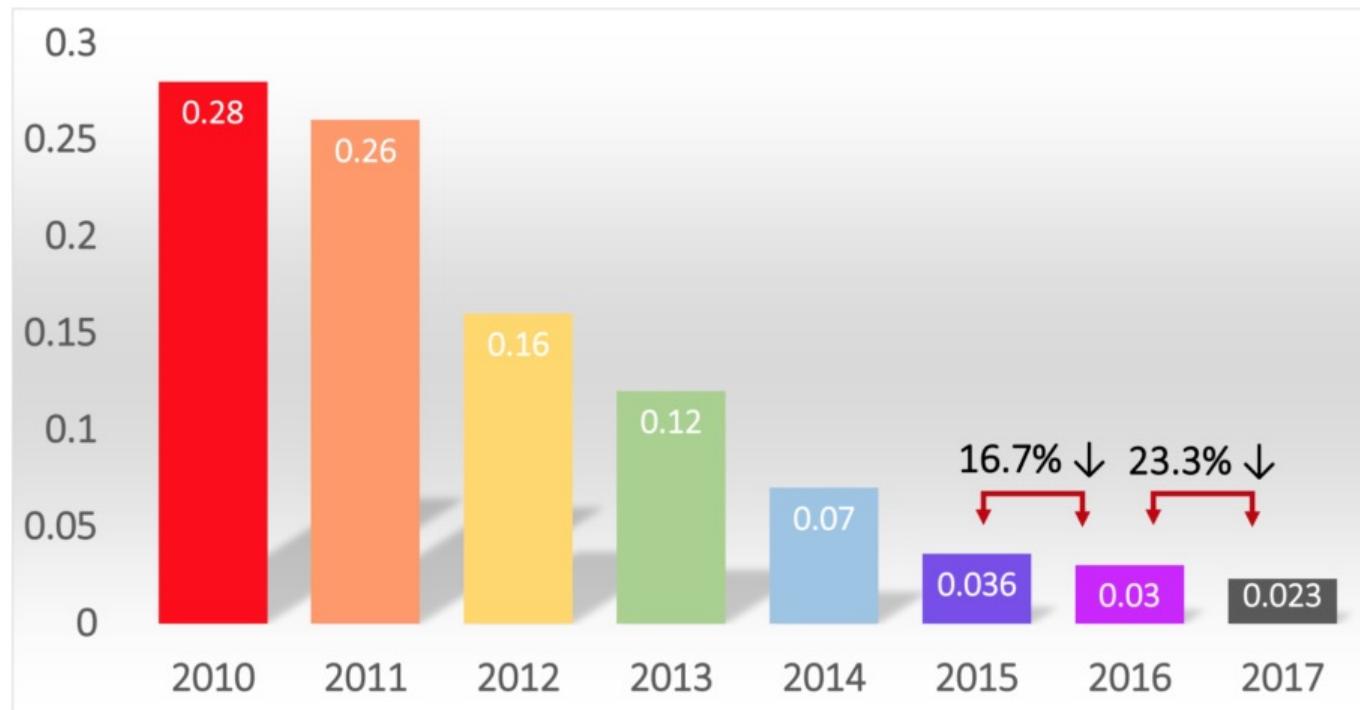
ImageNet

22K kategori (sınıf), 15M resim (Fei Fei)



<https://paperswithcode.com/sota/image-classification-on-imagenet>

ImageNet - Sınıflandırma Hataları



İnsan seviyesi hata: %5

<https://www.kaggle.com/getting-started/149448>

İnsan vs. BG



<http://karpathy.github.io/2012/10/22/state-of-computer-vision/>