

LOTRIČ METROLOGY

WE MEASURE. YOU GROW.

TRAMES

By LOTRIČ Metrology

Prilagojeni merilni sistemi
VISION METROLOGY

TRAMES Unique

Prilagojeni nadzorni sistemi
VISION INSPECTION

TRAMES Inspection

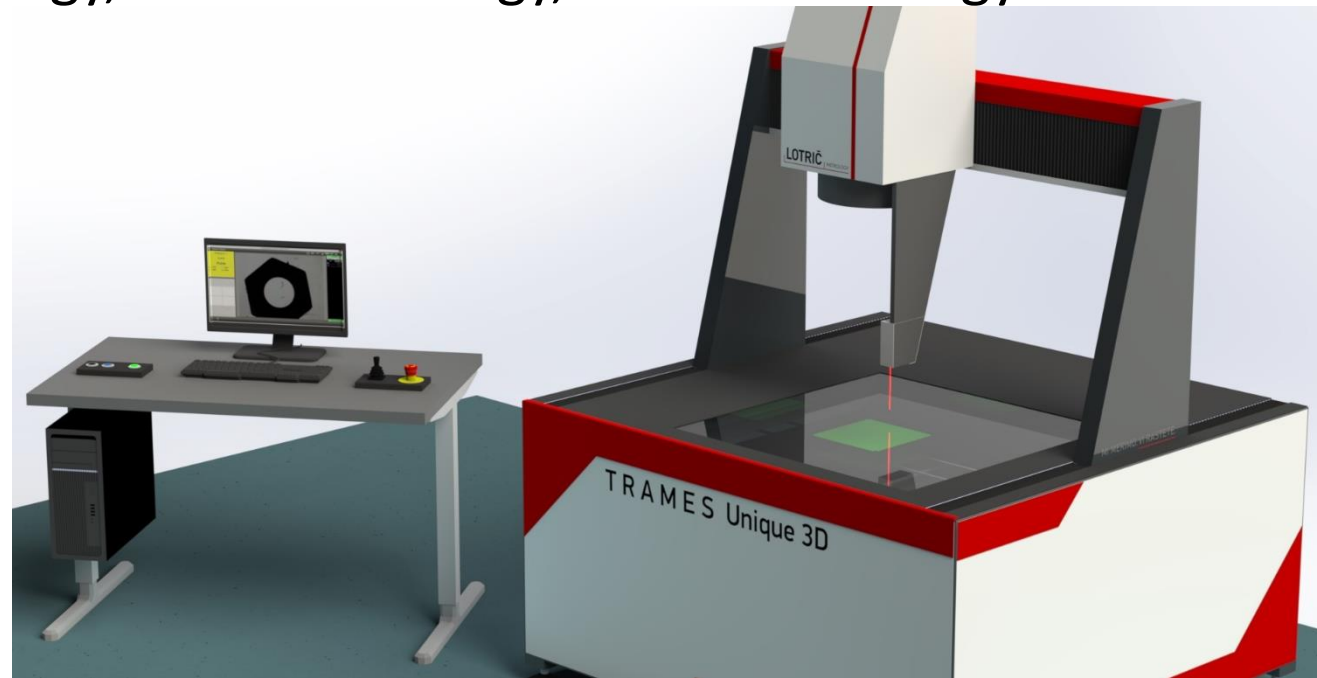
Kdaj in zakaj govorimo o prilagojenih /namenskih merilnih rešitvah?

- Ko na trgu ne najdemo serijske oz. tipske rešitve za določen merilni problem.
- Zahteve presegajo sposobnosti standardne rešitve.
- Želimo popolnoma nov merilni princip, ki bi reševal več problemov hkrati.

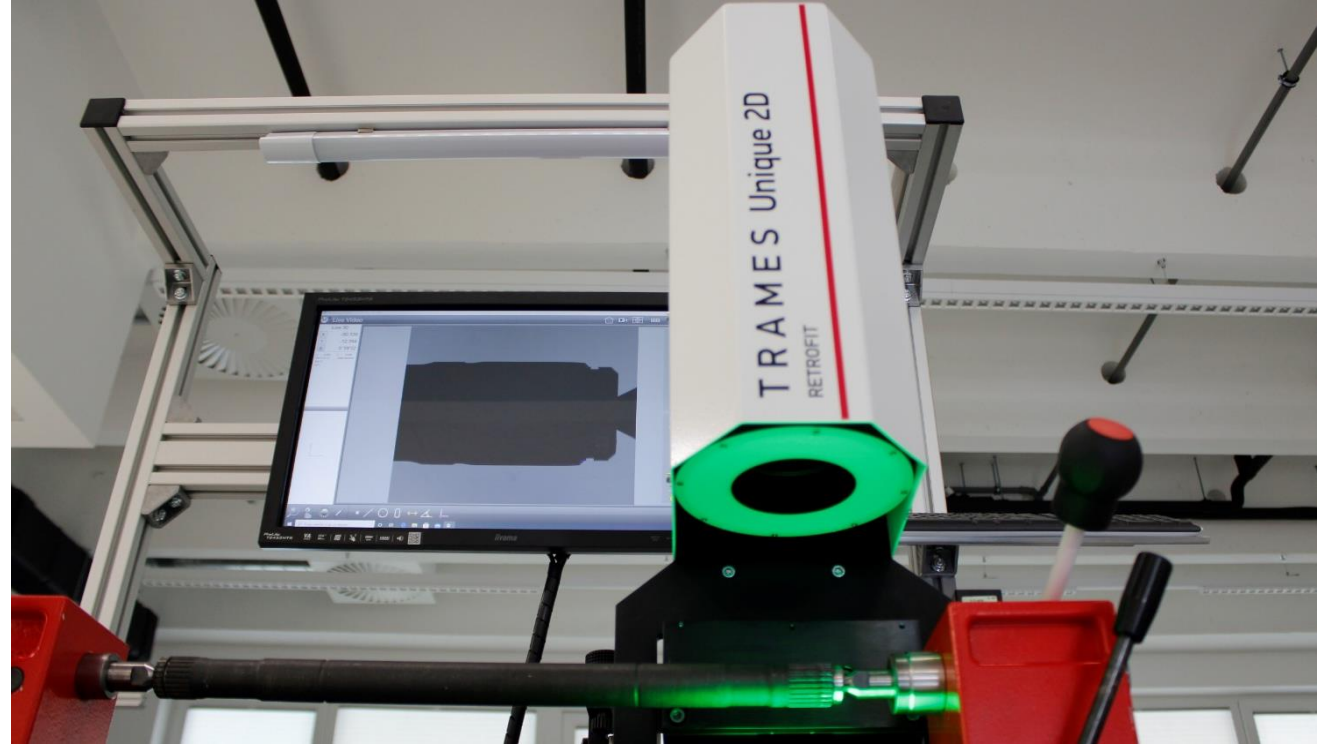
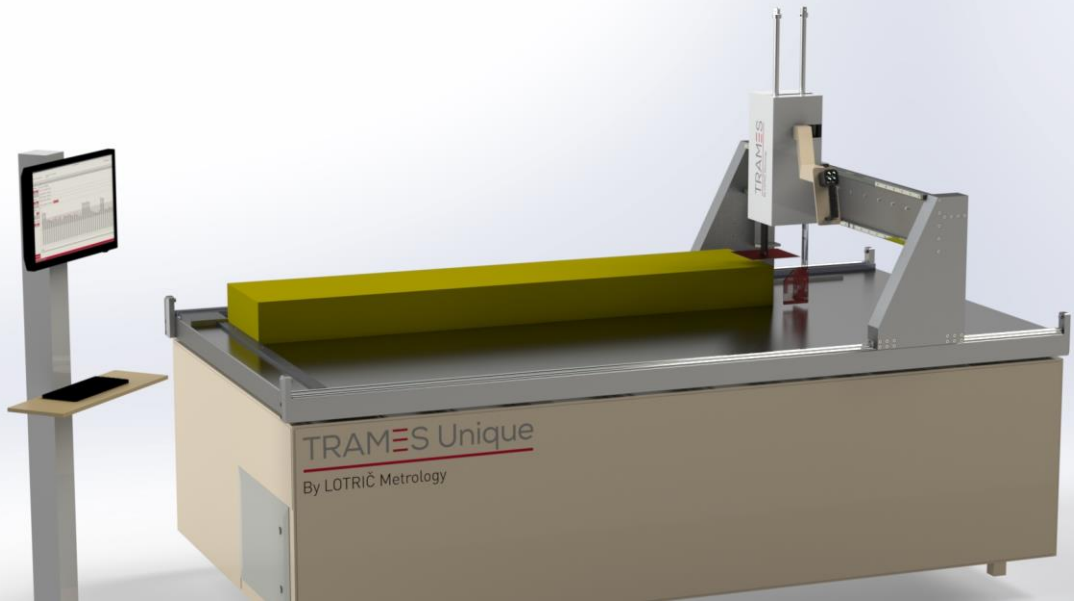


Merilni stroji za merjenje dimenzij

- Stacionarne ali linijske naprave
- Merjenje dimenzij v 1D, 2D in 3D prostoru
- Uporaba različnih merilnih principov:
Vision Metrology, Laser Metrology, Touch Metrology ...



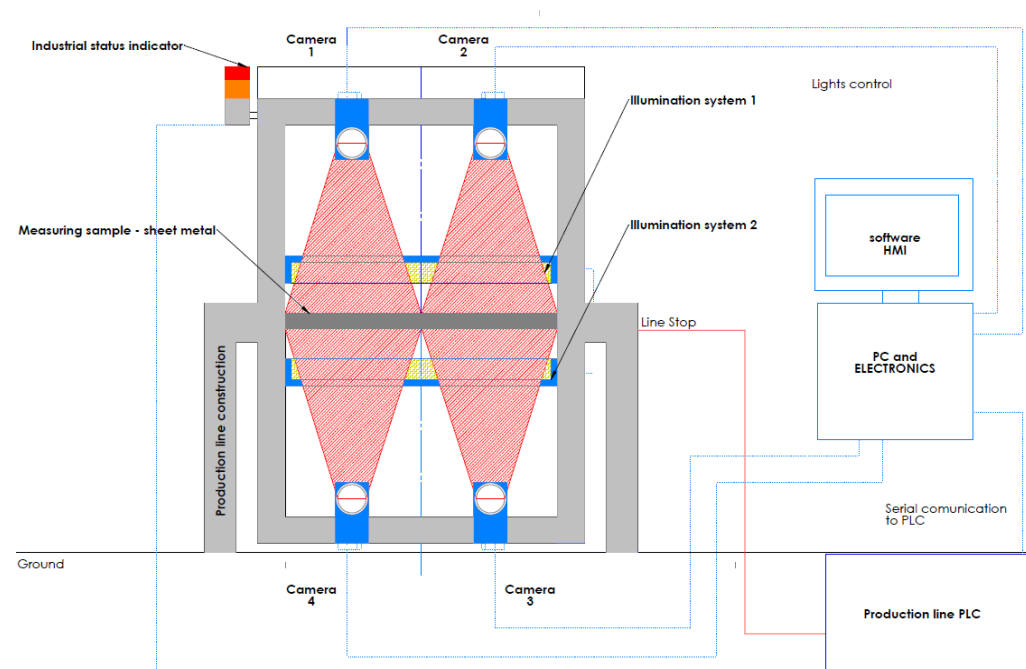
TRAMES Unique



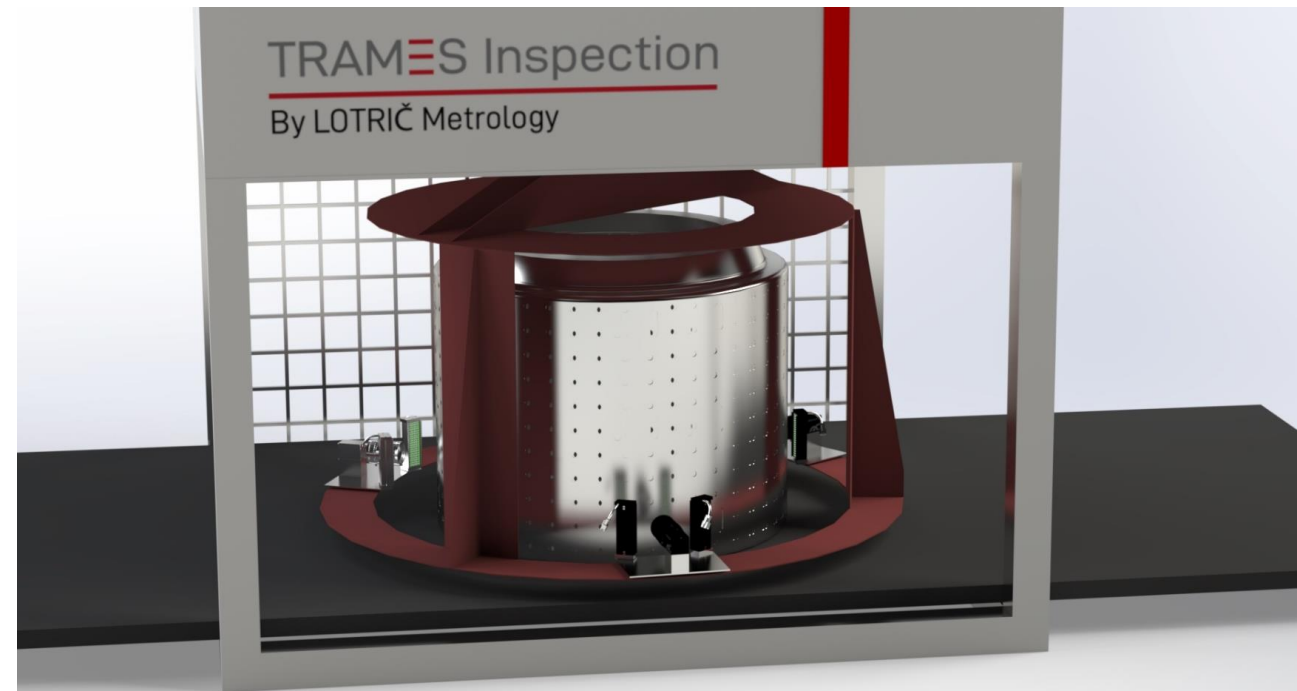
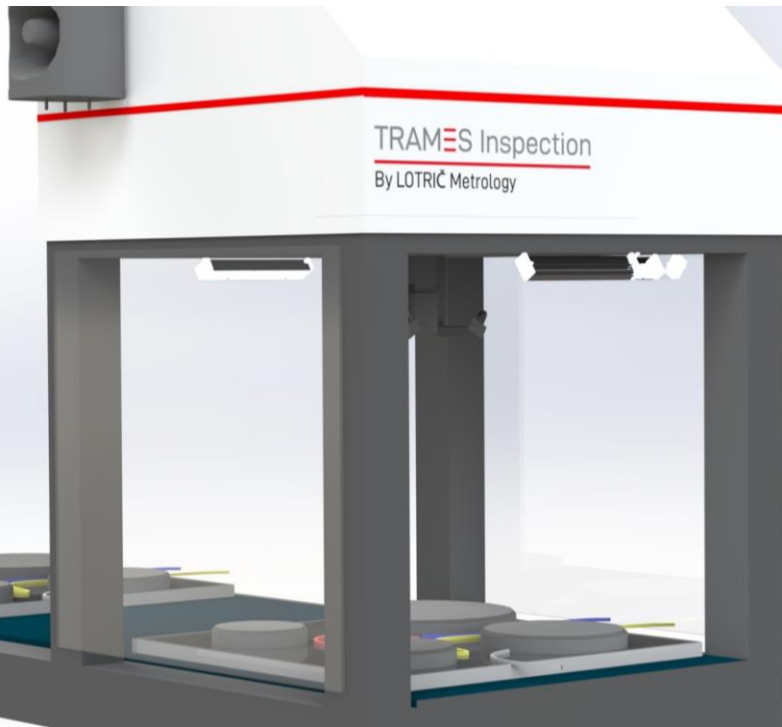
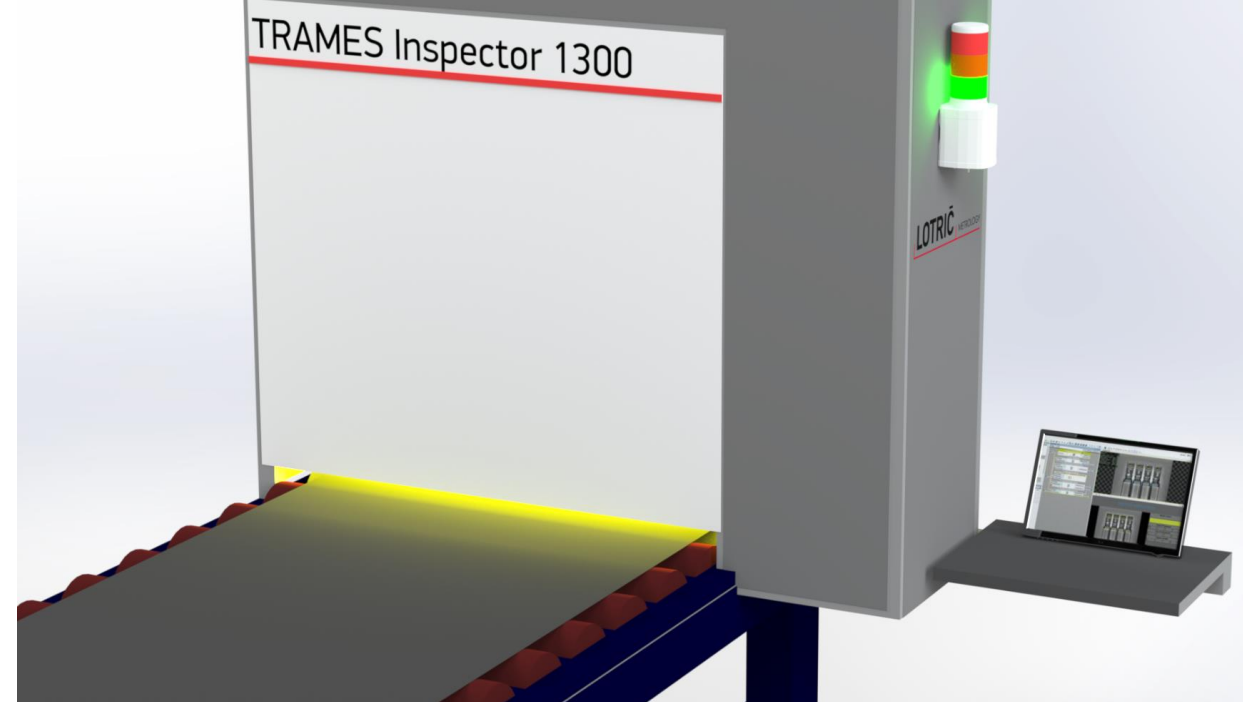
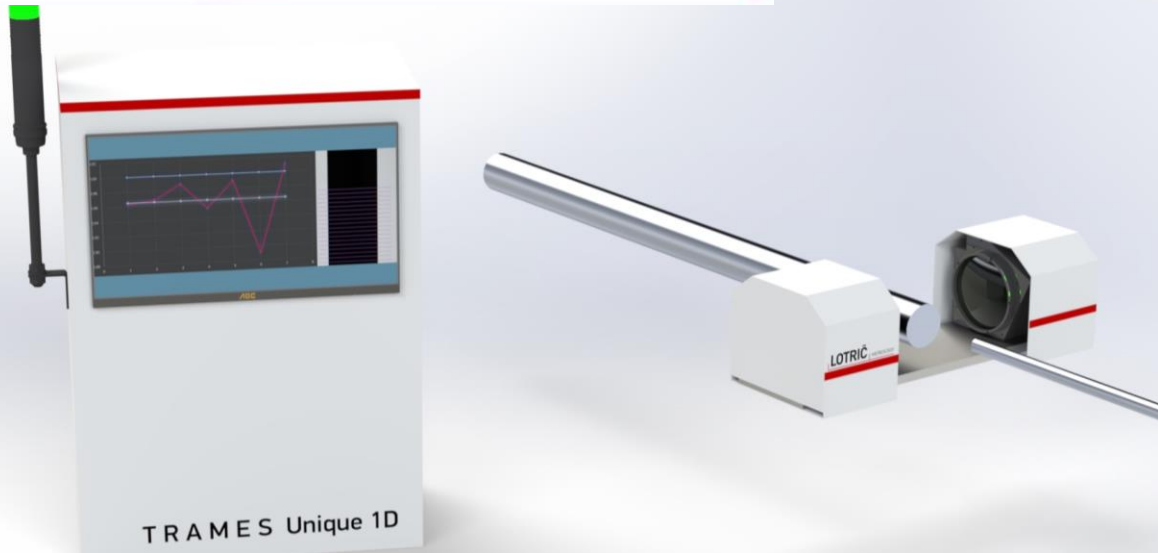
Nadzorni sistemi za kontrolo izdelkov

- Stacionarne ali linijske naprave
- Odkrivanje napak, poškodb, štetje, kontrola sestava, branje oznak
- Konkretni primeri: Merjenje srha (igle) na pločevini, kontrola pravilnosti reza (hrapavost rezne površine)
- Uporaba različnih principov:

Vision inspection
Laser inspection

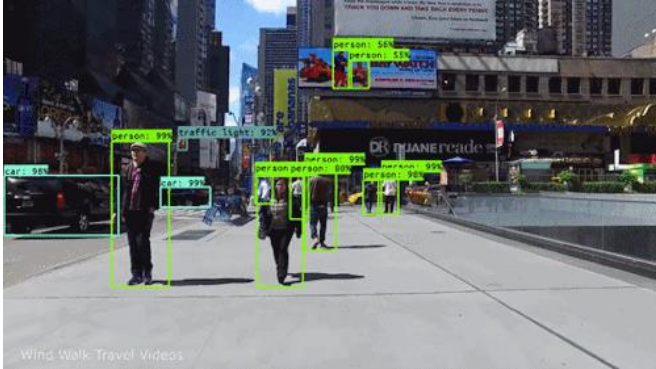


TRAMES Inspection

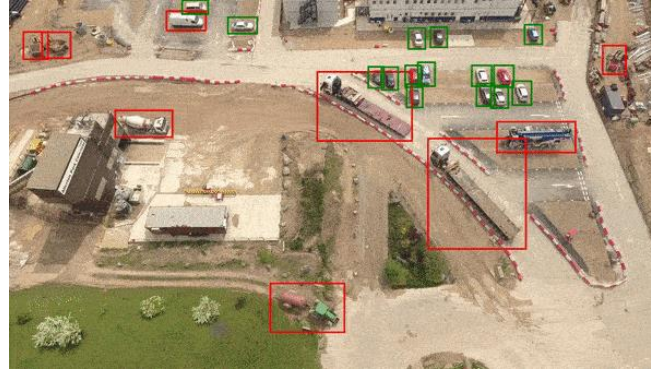


Uporaba klasičnih in naprednih metod
strojnega vida v industriji

Računalniški vid, strojni vid



Vir: <https://pythonawesome.com/learn-and-get-more-computer-vision-skills-with-python/>



Vir: <https://medium.com/nanonets/how-we-flew-a-drone-to-monitor-construction-projects-in-africa-using-deep-learning-b792f5c9c471>



Vir: <https://towardsdatascience.com/semantic-segmentation-with-deep-learning-a-guide-and-code-e52fc8958823>

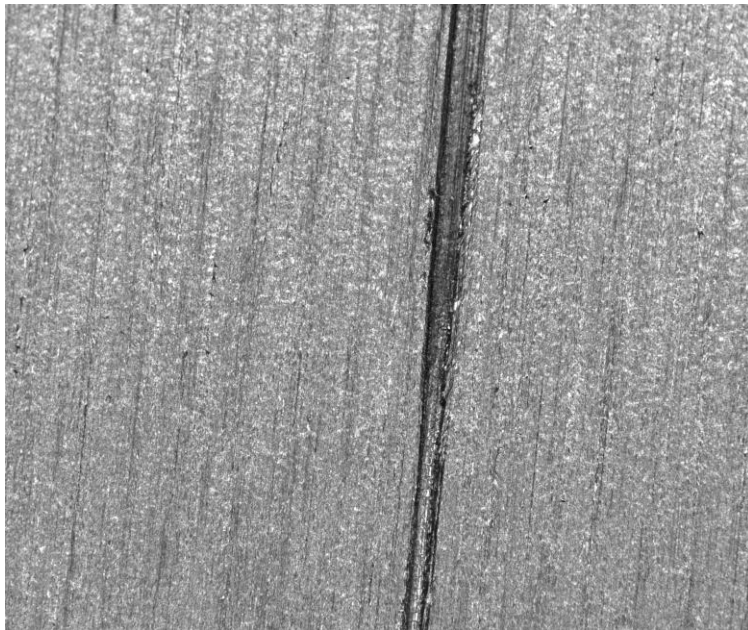


Vir: <https://www.dynamicsolutionsusa.com/cognex-machine-vision-systems>

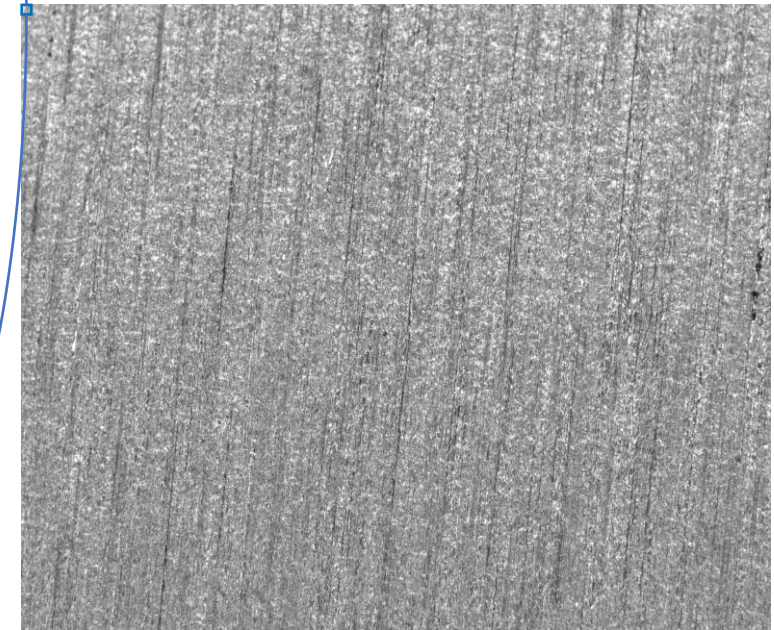


Vir: <https://www.youtube.com/watch?v=KXMPk3FKHgA>

Izzivi računalniškega vida



204	201	207	203	200	203	200	200	200	201	204	211
194	206	204	199	193	203	201	204	199	200	205	207
196	200	199	200	192	199	204	202	201	197	194	200
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181	193	198	205	205	207	216	213	205	207	204	204
193	192	201	203	209	208	217	211	209	209	214	212
193	195	202	205	208	209	213	215	215	222	225	227
195	197	202	211	205	211	218	212	217	222	234	225



Izzivi računalniškega vida

Variacija pogleda



Sprememba v merilu



Deformacija



Okluzija



Pogoji osvetlitve



Nered v ozadju



Variacije znotraj razreda



Vir: <https://cs231n.github.io/classification/>

Arhitektura sistema strojnega vida

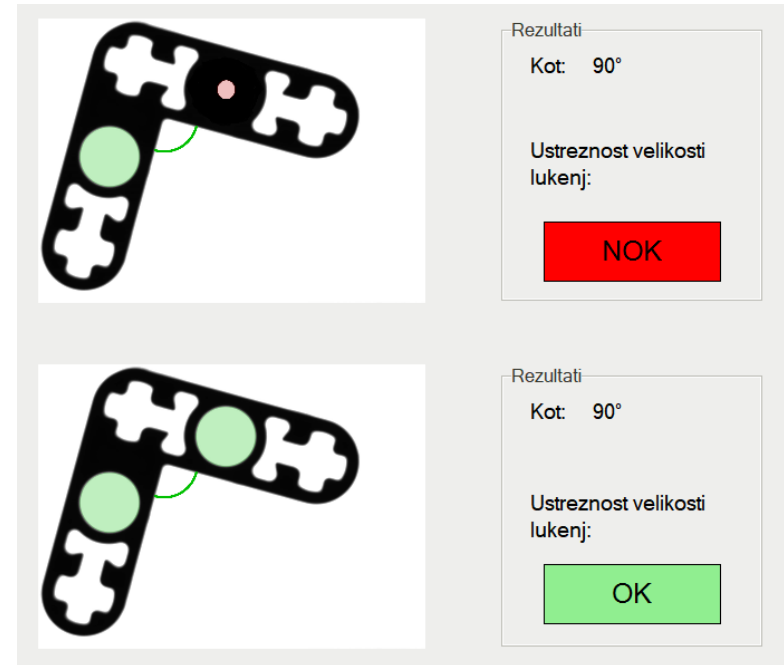
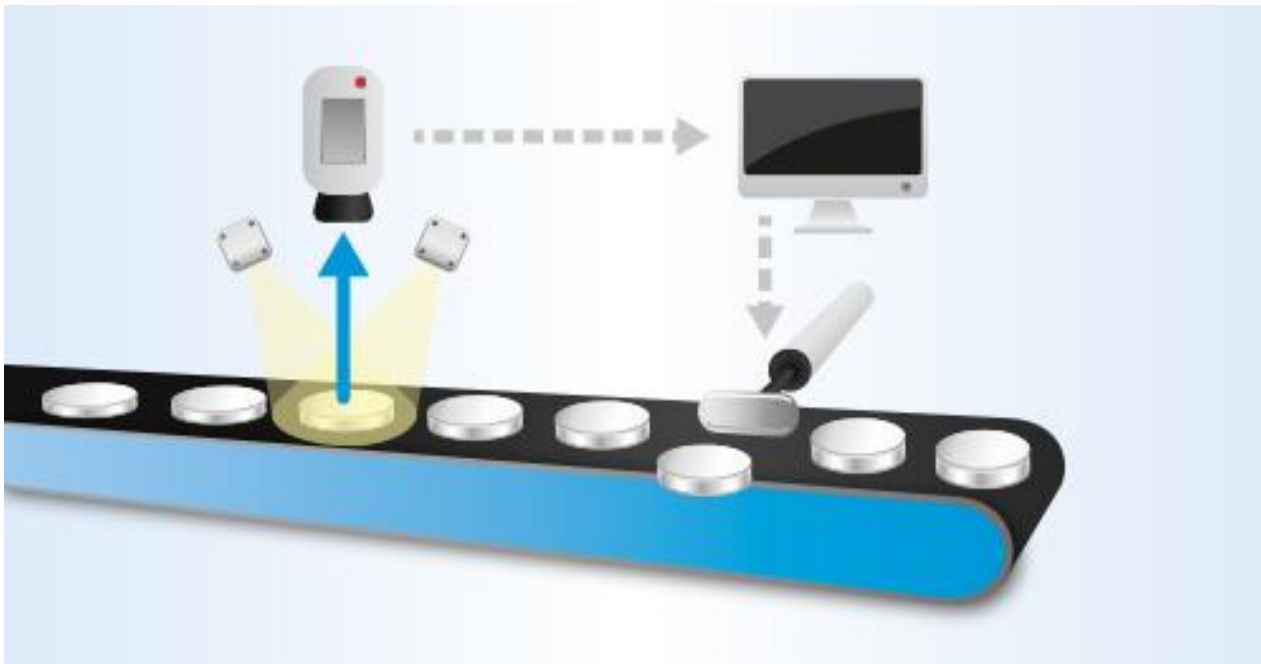
Pridobivanje slik



obdelava slik (značilke)

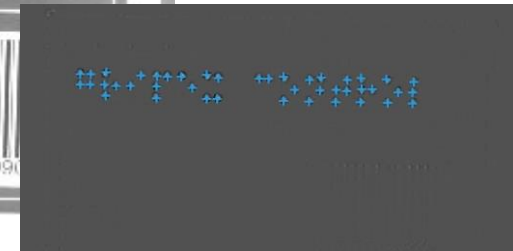
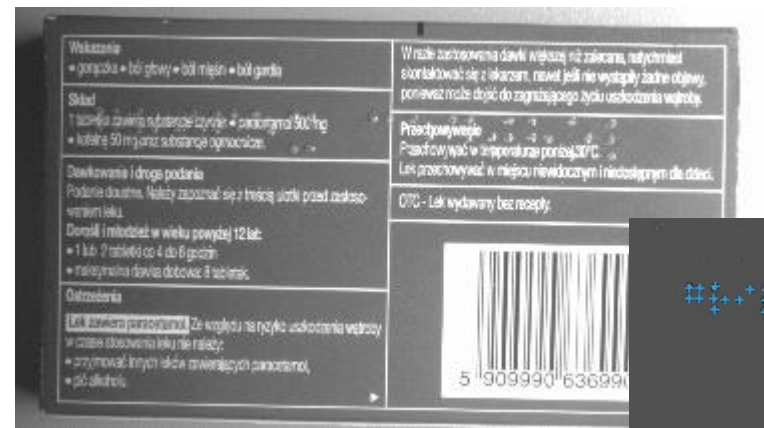


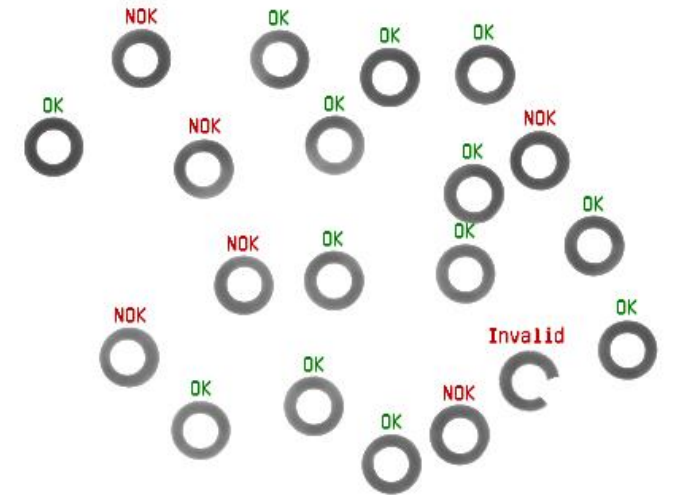
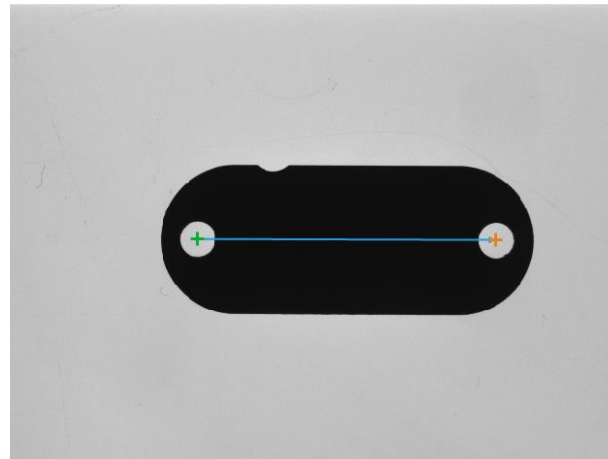
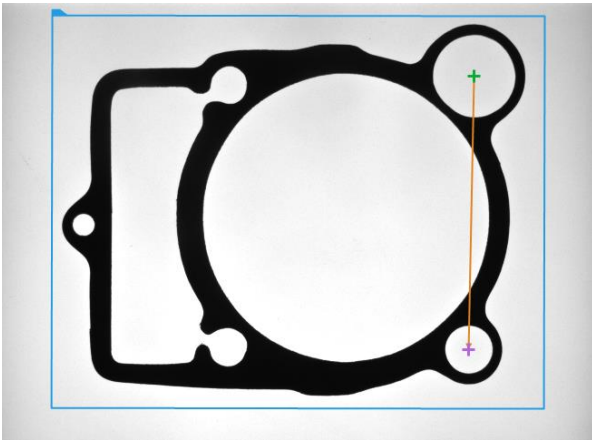
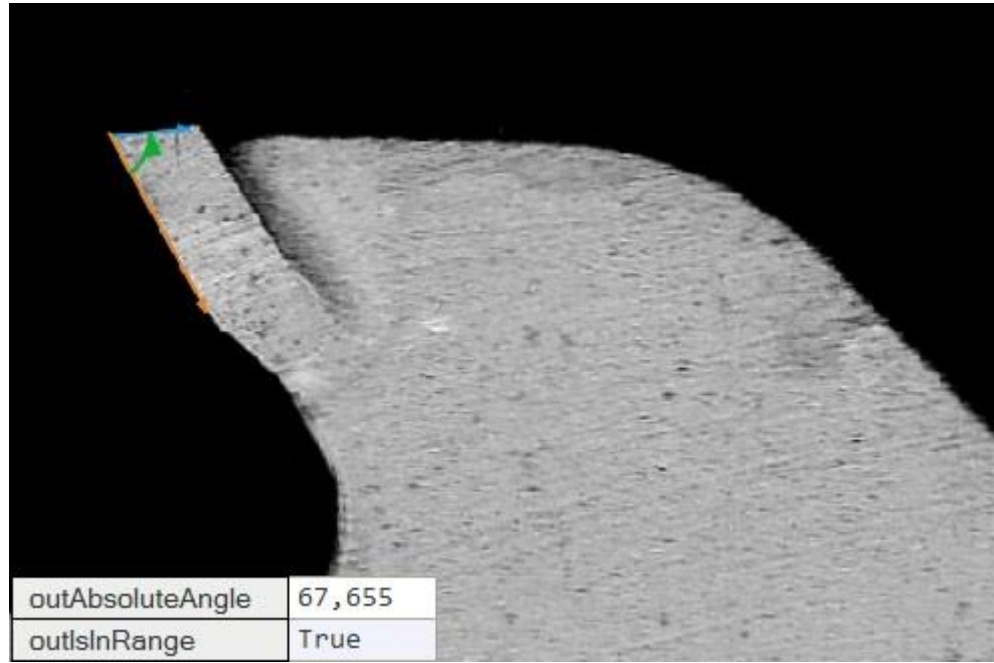
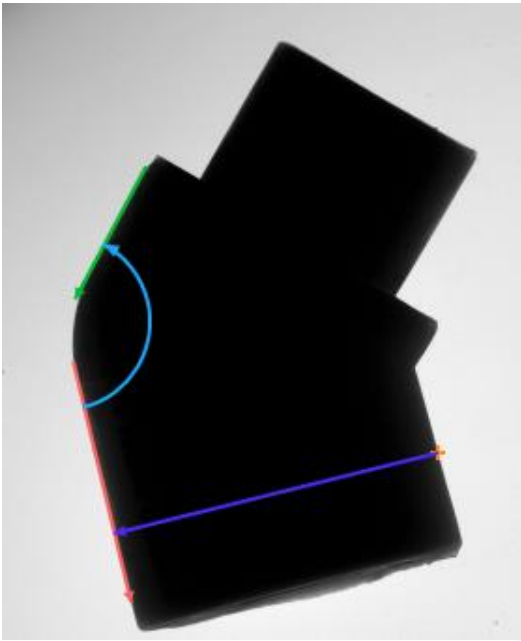
klasifikacija ali izračun

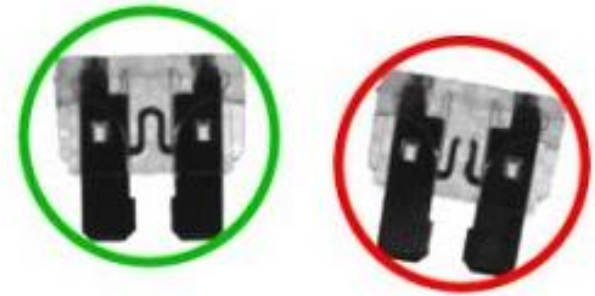
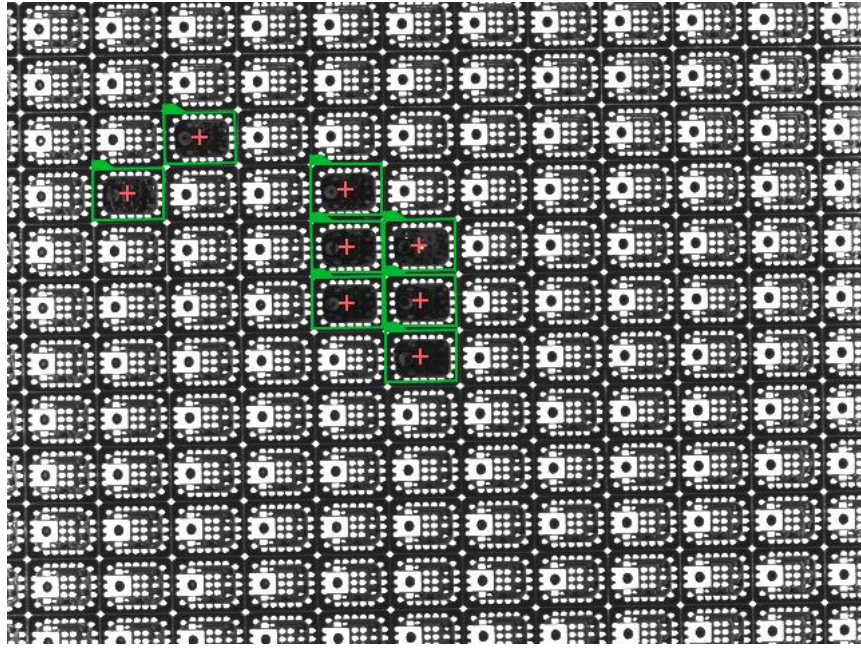


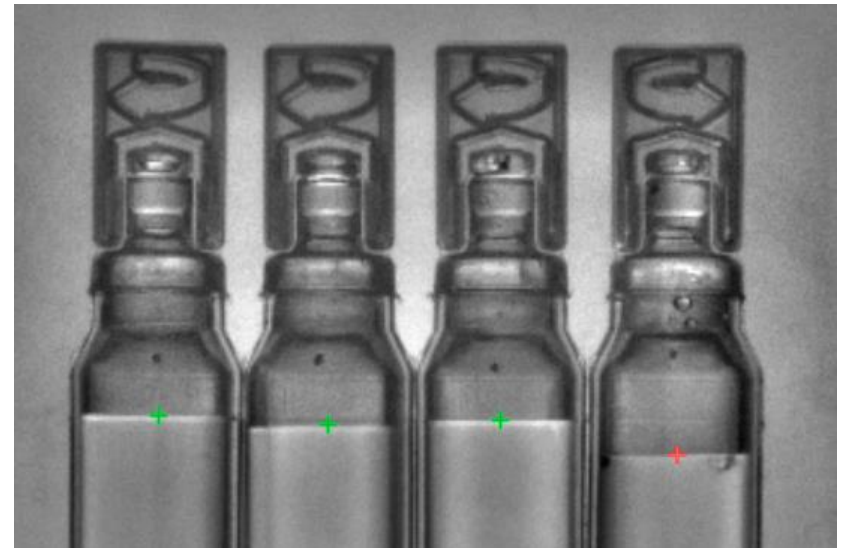
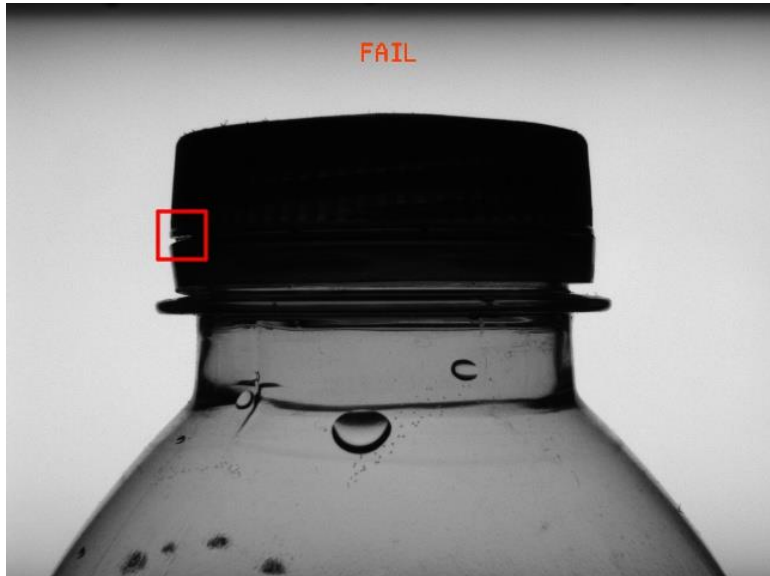
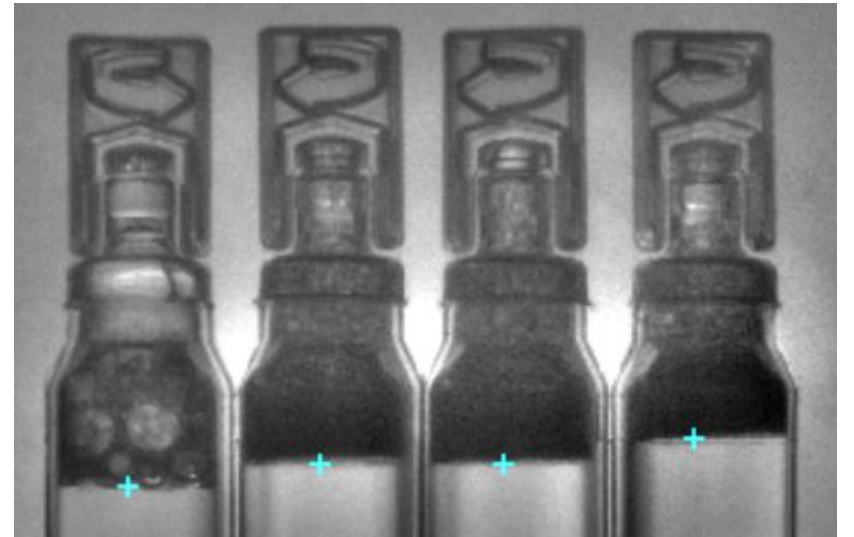
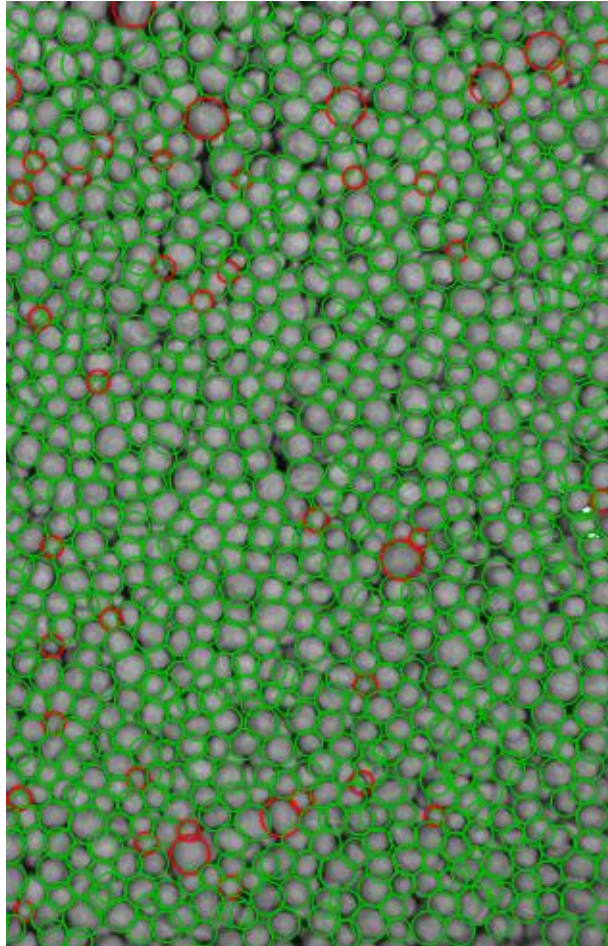
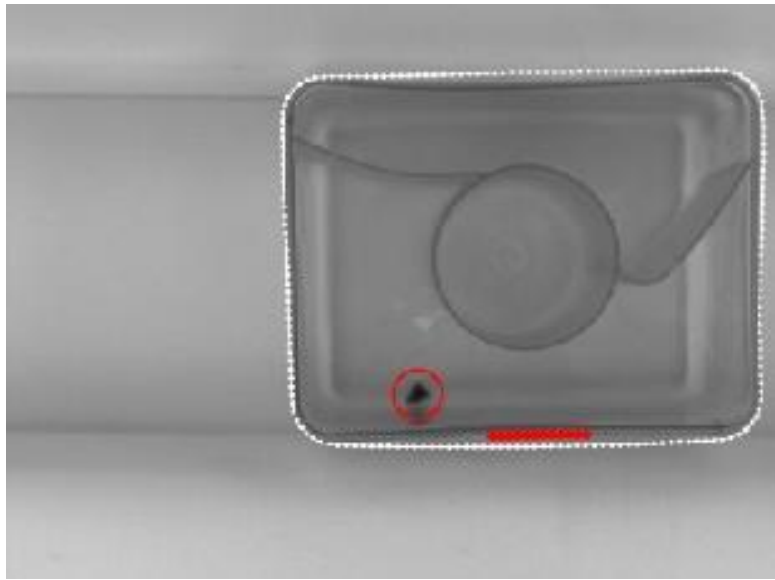


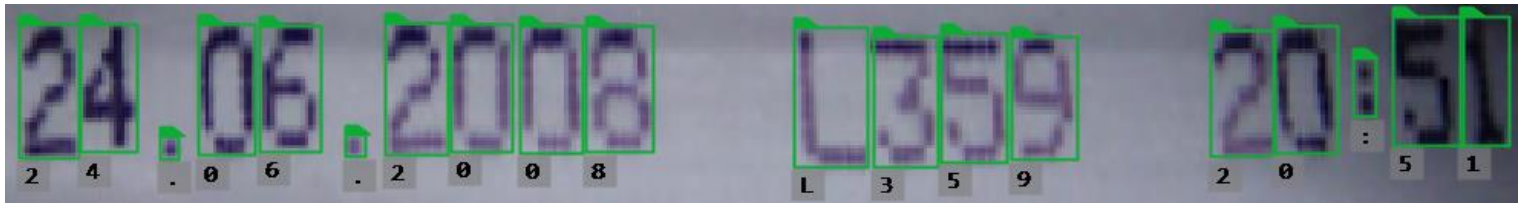
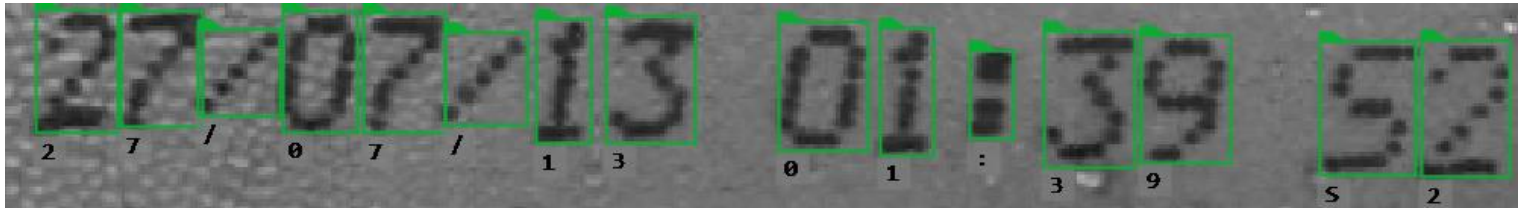
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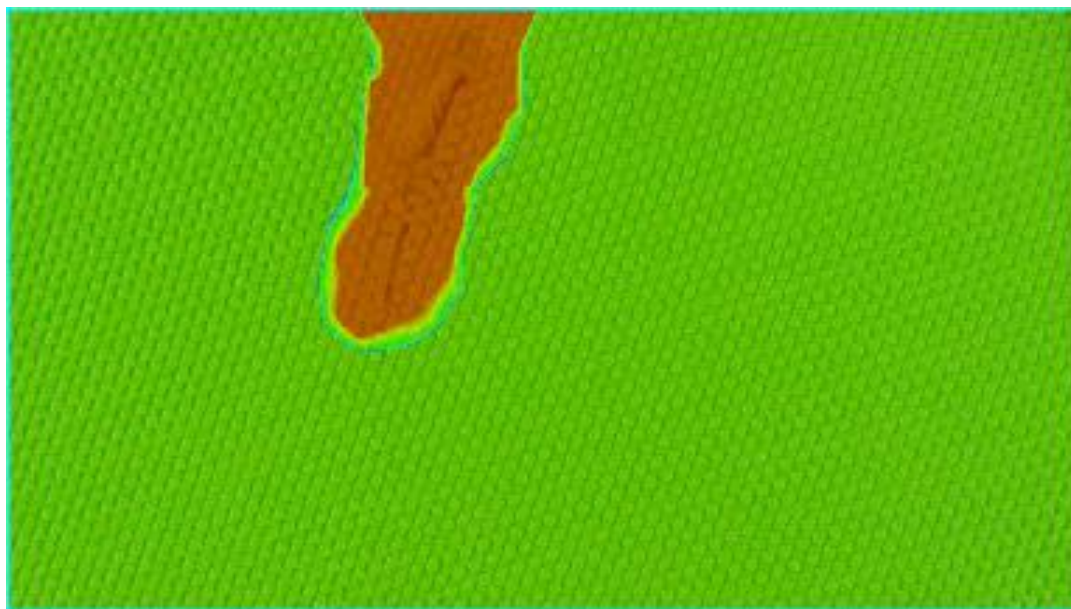




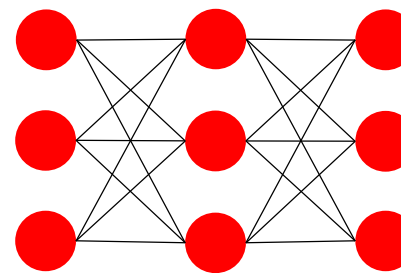
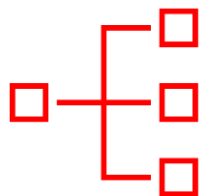
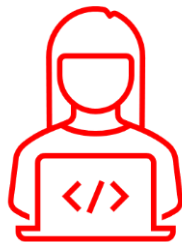
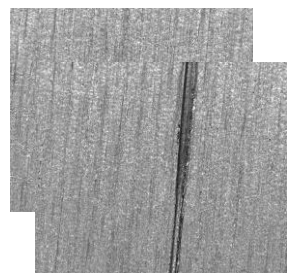








Klasično strojno učenje



Vhodna slika

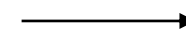
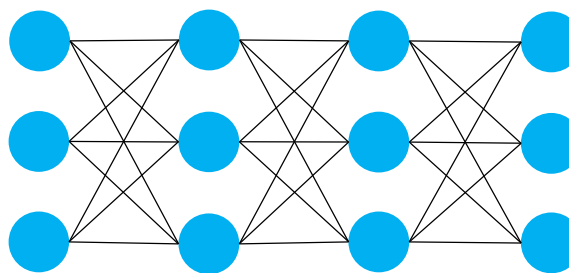
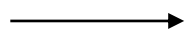
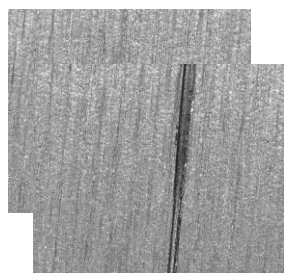
Luščenje značilk

Značilke

Klasični algoritem strojnega učenja (klasifikacija)

Izhod

Globoko učenje

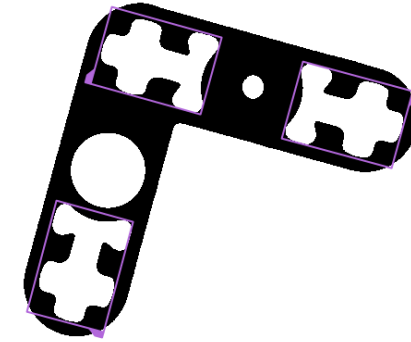


Vhodna slika

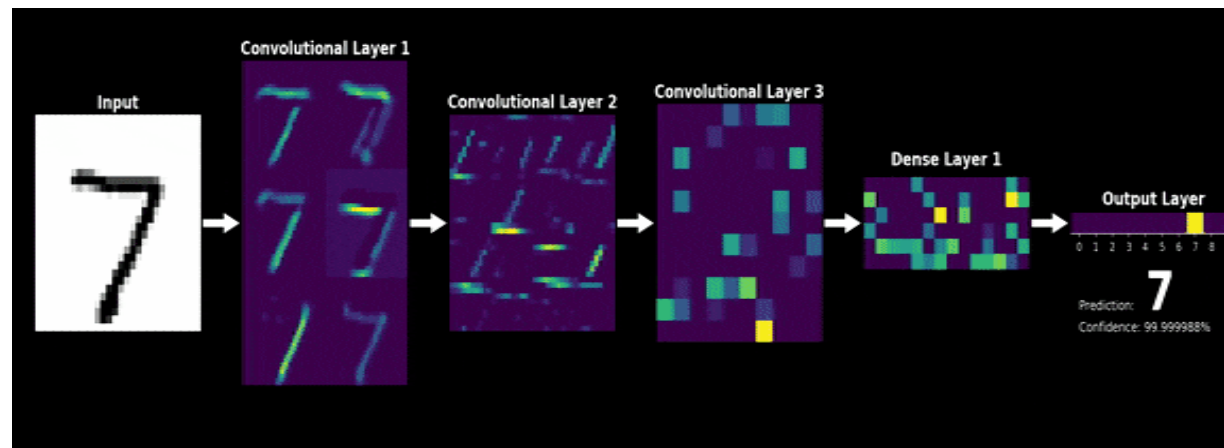
Algoritem globokega učenja (luščenje značilk + klasifikacija)

Izhod

Klasično strojno učenje



Globoko učenje



Vir: <https://gfycat.com/affectionatememorablegreyhounddog-artificial-intelligence-neural-networks>

Klasično strojno učenje



Preglednost



Določanje značilk

Kompleksne značilke

Globoko učenje



Učenje kompleksnih značilk



Interpretacija izhodnih rezultatov

Veliko število parametrov in vhodnih podatkov (učenje mreže)

Zaključek

- Globoko učenje eno izmed orodij računalniškega vida
- Kombinacija klasičnih metod in globokega učenja