ANALIZA UČINKOVITOSTI KLASIFIKACIJE MEDICINSKIH HISTOPATOLOŠKIH SLIKA KORIŠTENJEM DUBOKIH NEURONSKIH MREŽA

DIPLOMSKI RAD

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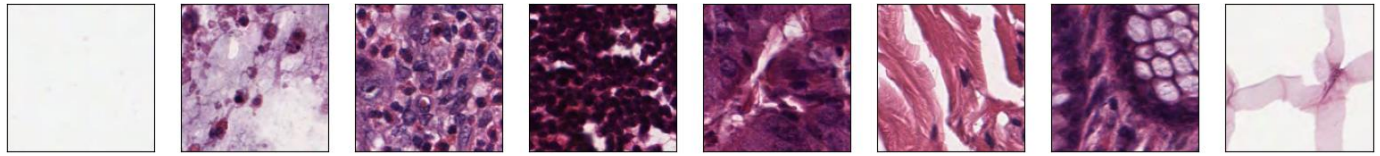
SADRŽAJ

KOLOREKTALNI KARCINOM

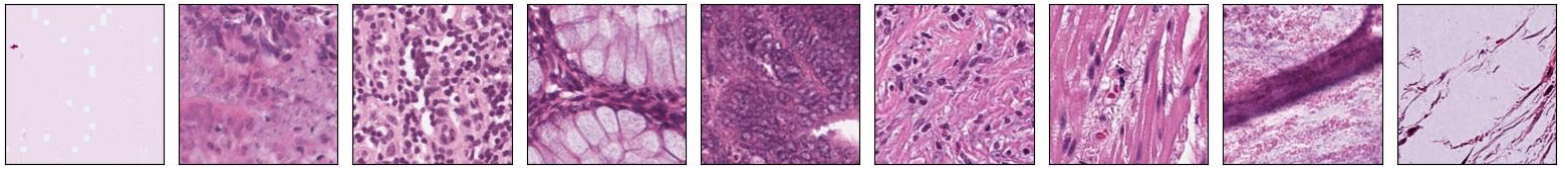
- debelo crijevo (kolon) + rektum
- treći najčešći rak u svijetu i drugi vodeći uzrok smrti povezanih s rakom
- Dijagnosticiranje „ručno”
- Prednosti automatizirane klasifikacije tkiva

SKUPOVI PODATAKA

- histopatološke fotografije
- Kako su **labelirani** skupovi podataka kreirani?
- Colorectal Histology, Kather (2016)

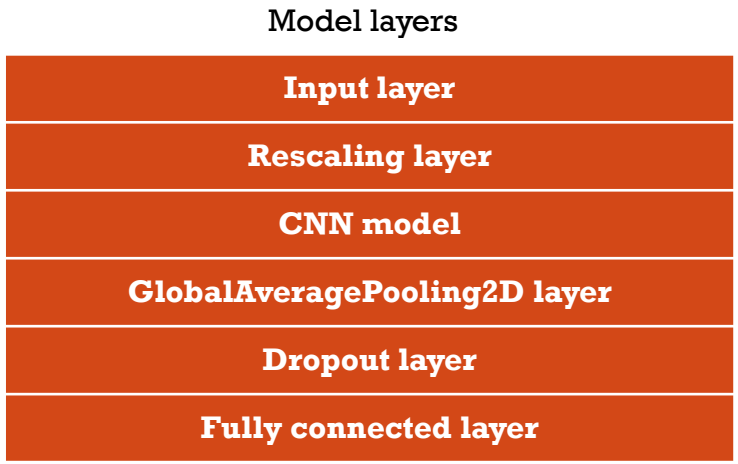


- NCT-CRC-HE-100K and CRC-VAL-HE-7K, Kather (2019)



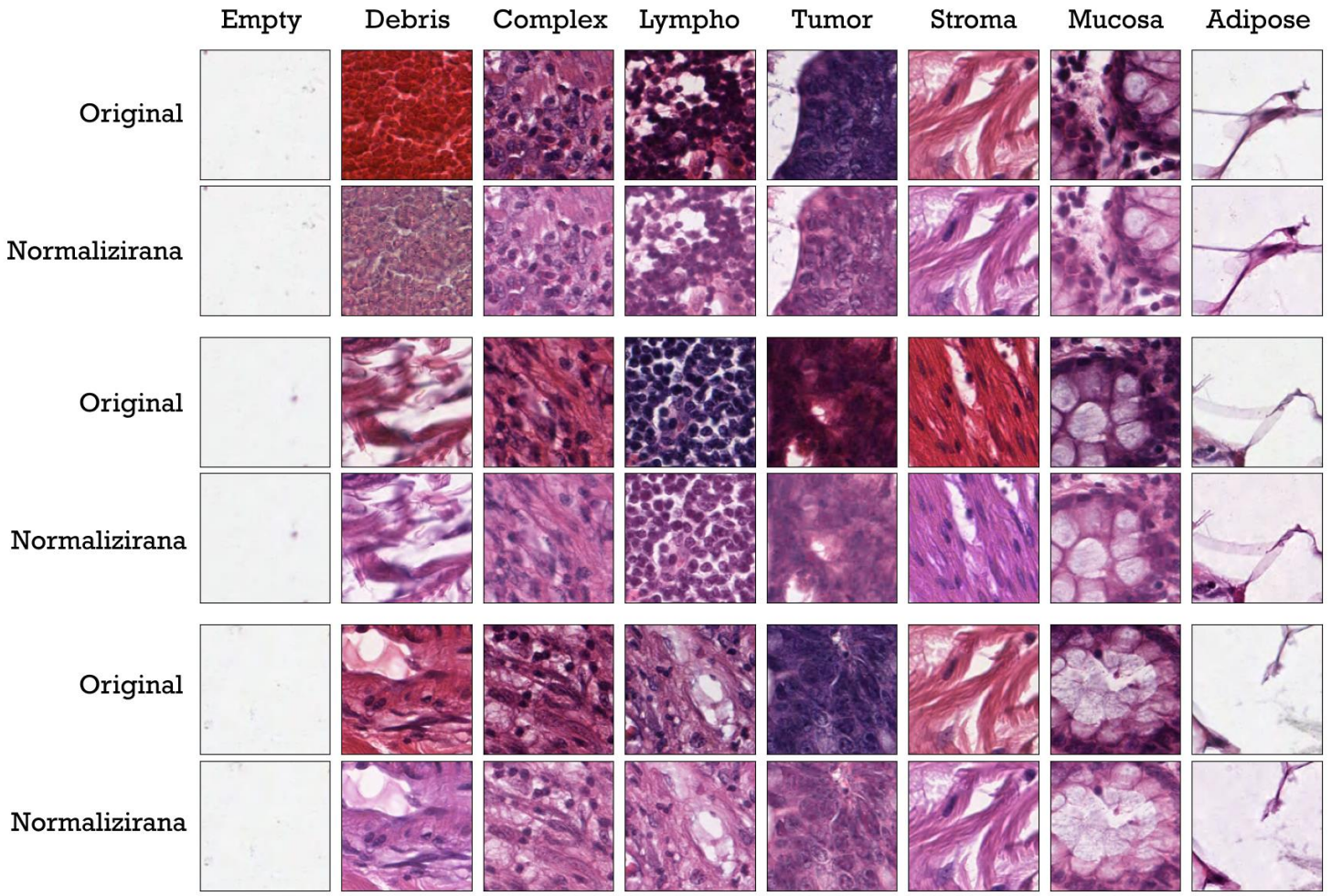
KLASIFIKACIJA

- Modeli
  - VGG19
  - MobileNetV2
  - EfficientNetB0
- Prijenosno učenje
- Trening u dva koraka
- Podjela skupa podataka 75:15:15 (Experiment 1 i 2)



EXPERIMENT 1 – NORMALIZACIJA BOJENJA

- Ciompi (2017)
- Macenko
- Colorectal Histology skup podataka



EXPERIMENT 1 – NORMALIZACIJA BOJENJA

Colorectal Histology dataset with and without SN

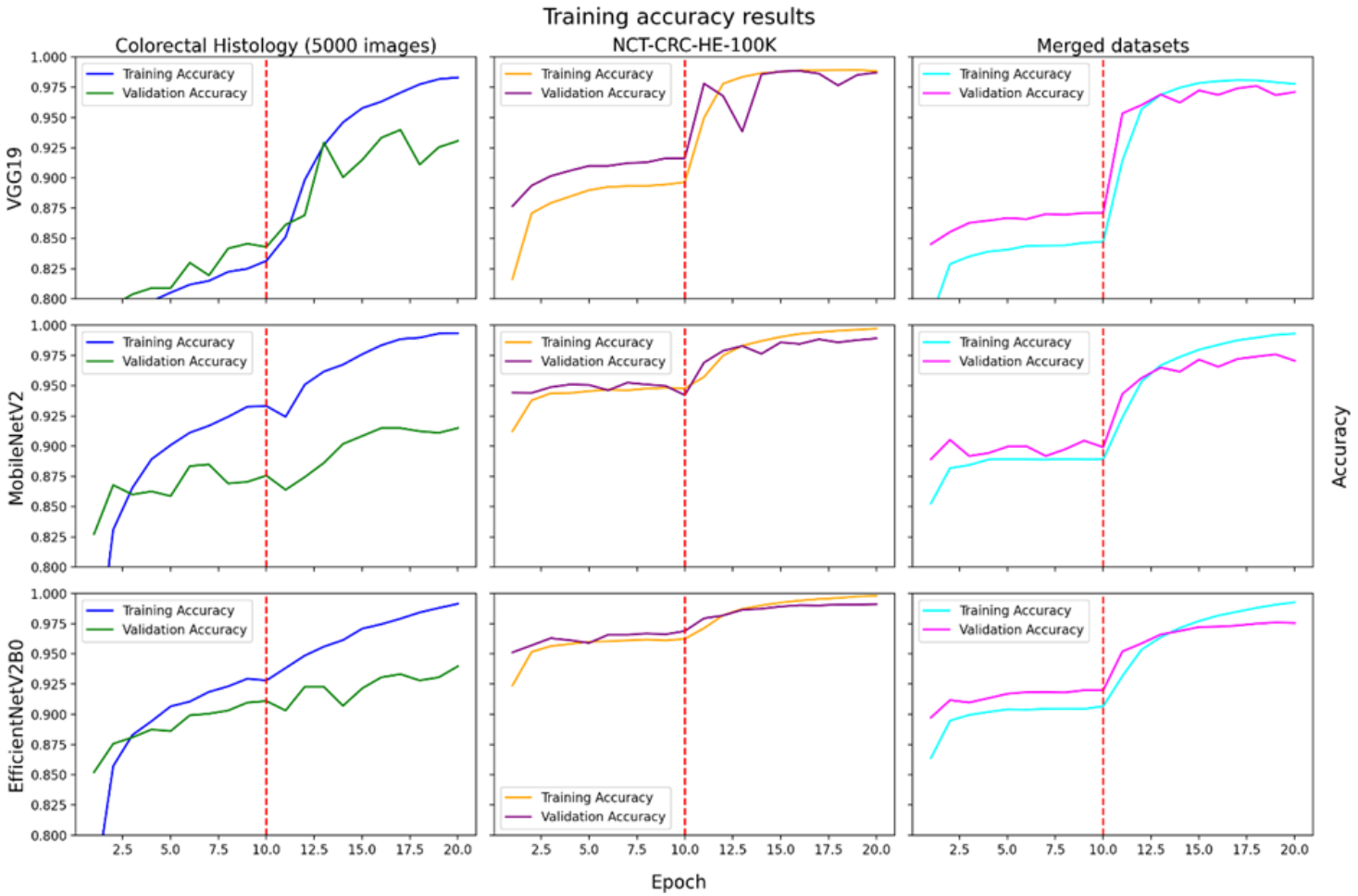
Model name	Dataset version	Accuracy
VGG19	w/o SN	92,93%
	w SN	91,17%
	Δ	-1,77%
MobileNetV2	w/o SN	92,66%
	w SN	90,22%
	Δ	-2,45%
EfficientnetV2B0	w/o SN	93,61%
	w SN	92,53%
	Δ	-1,09%

Merged dataset with and without SN applied on the Colorectal Histology dataset

Model name	Dataset version	Accuracy
VGG19	w/o SN	97,95%
	w SN	96,74%
	Δ	-1,21%
MobileNetV2	w/o SN	97,69%
	w SN	97,07%
	Δ	-0,62%
EfficientnetV2B0	w/o SN	97,70%
	w SN	97,36%
	Δ	-0,34%

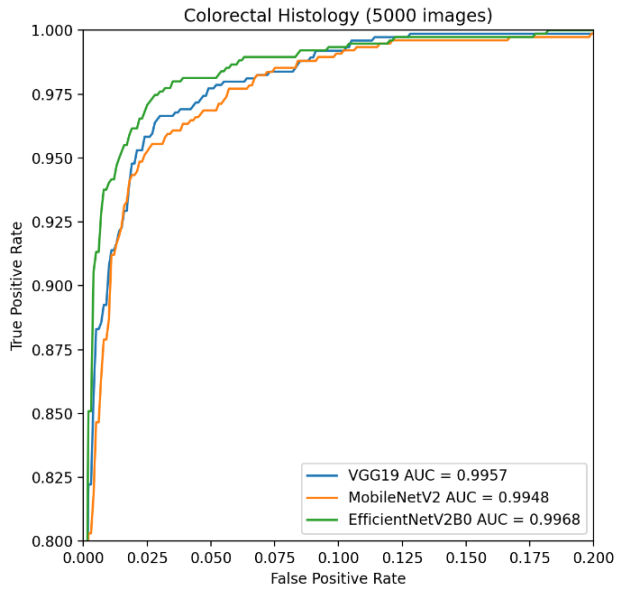
EXPERIMENT 2 – REPRODUKCIJA REZULTATA IZ LITERATURE

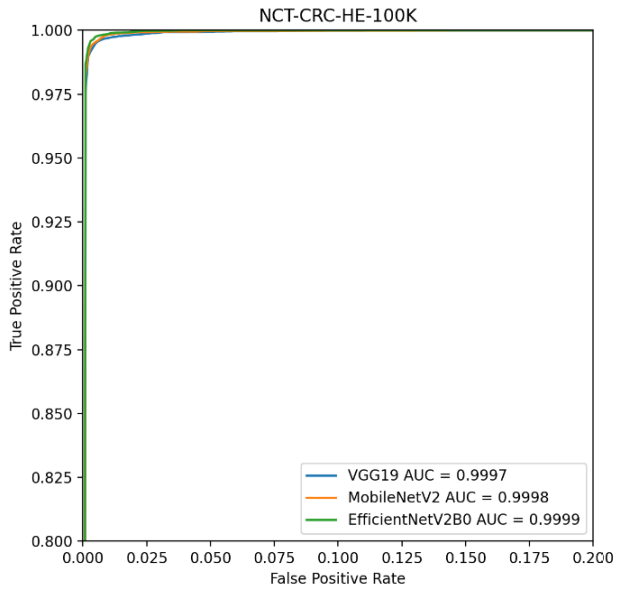
- Martinez-Fernandez (2023)
- Trening u dva koraka

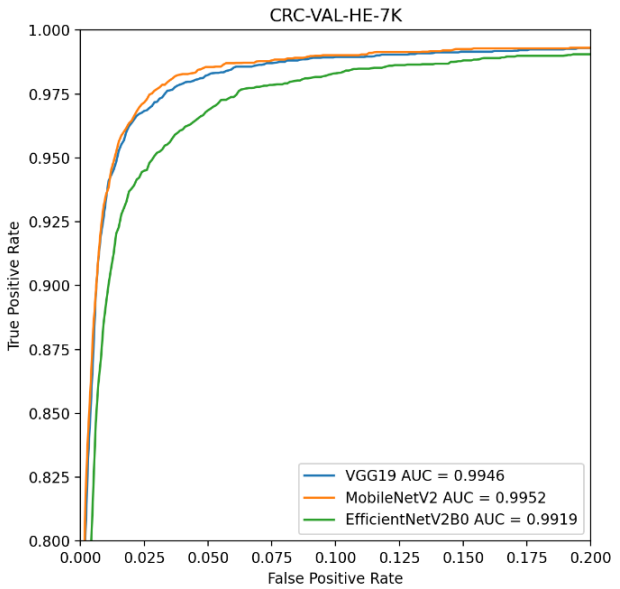


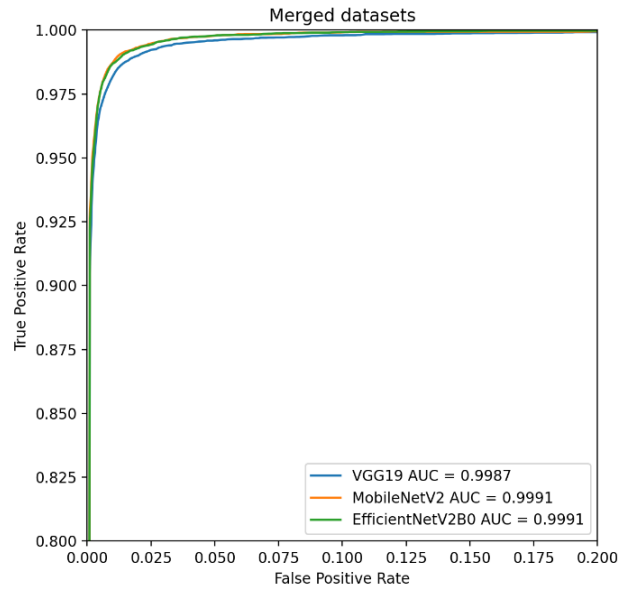
Training accuracy result metrics

EXPERIMENT 2 – REPRODUKCIJA REZULTATA IZ LITERATURE



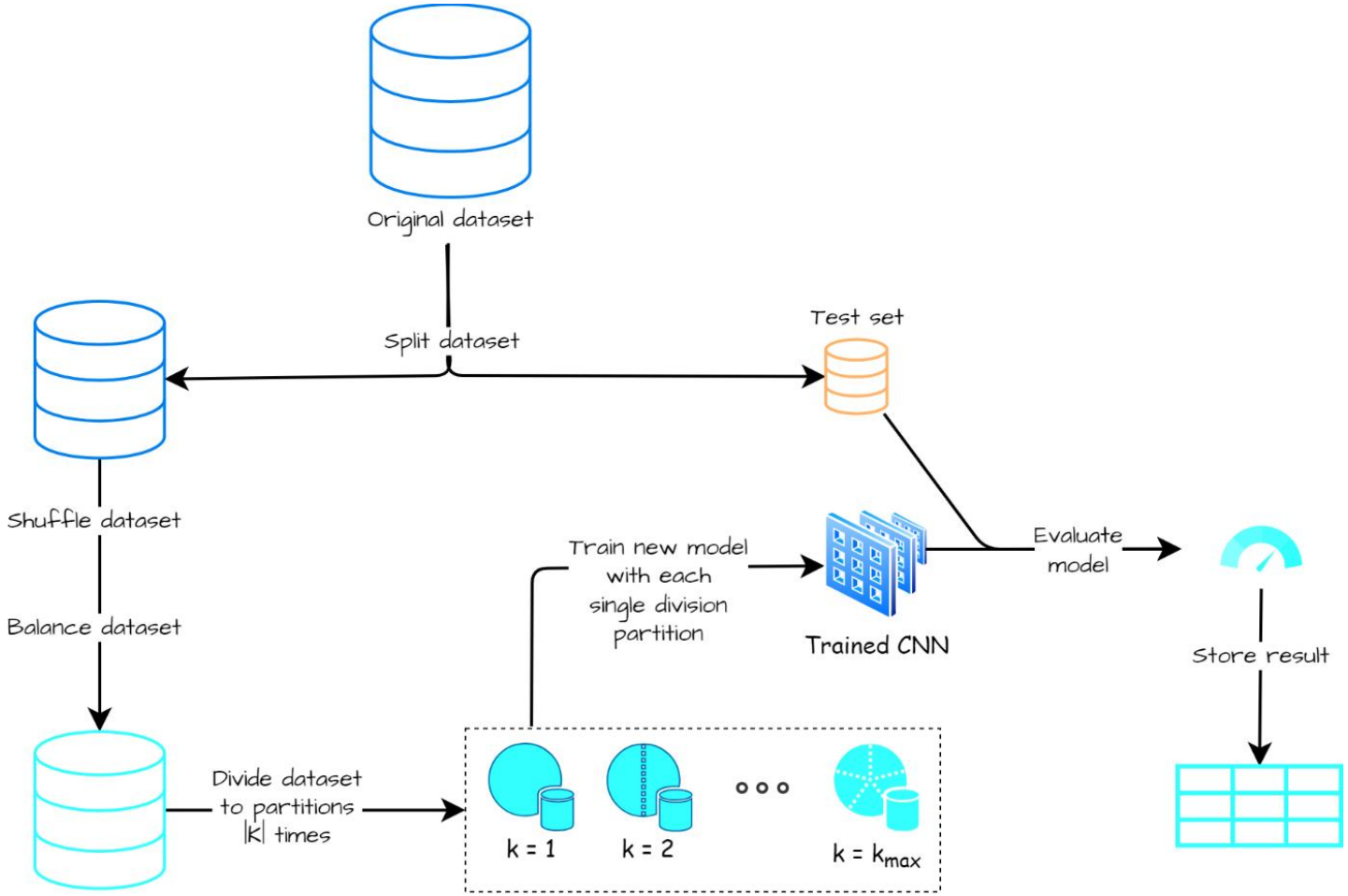






Macro averaged roc curves (One vs. Rest)

EXPERIMENT 3 – ITERATIVNI ALGORITAM



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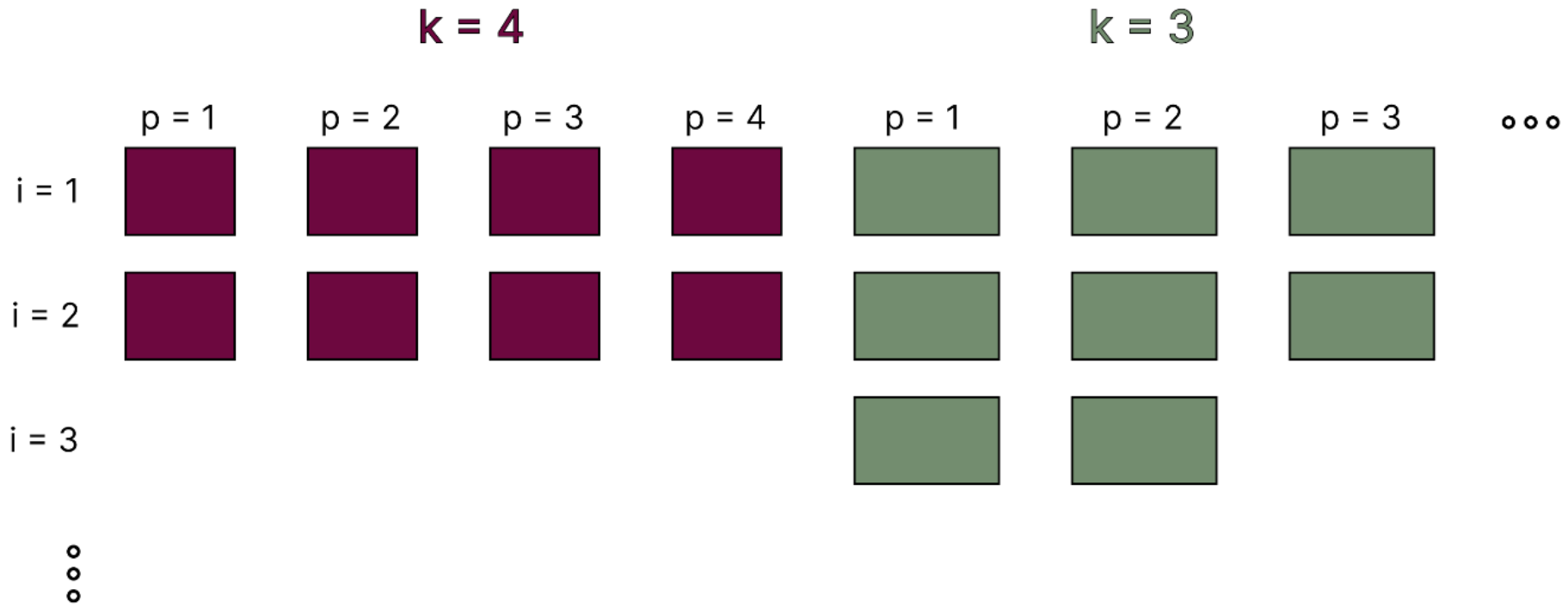

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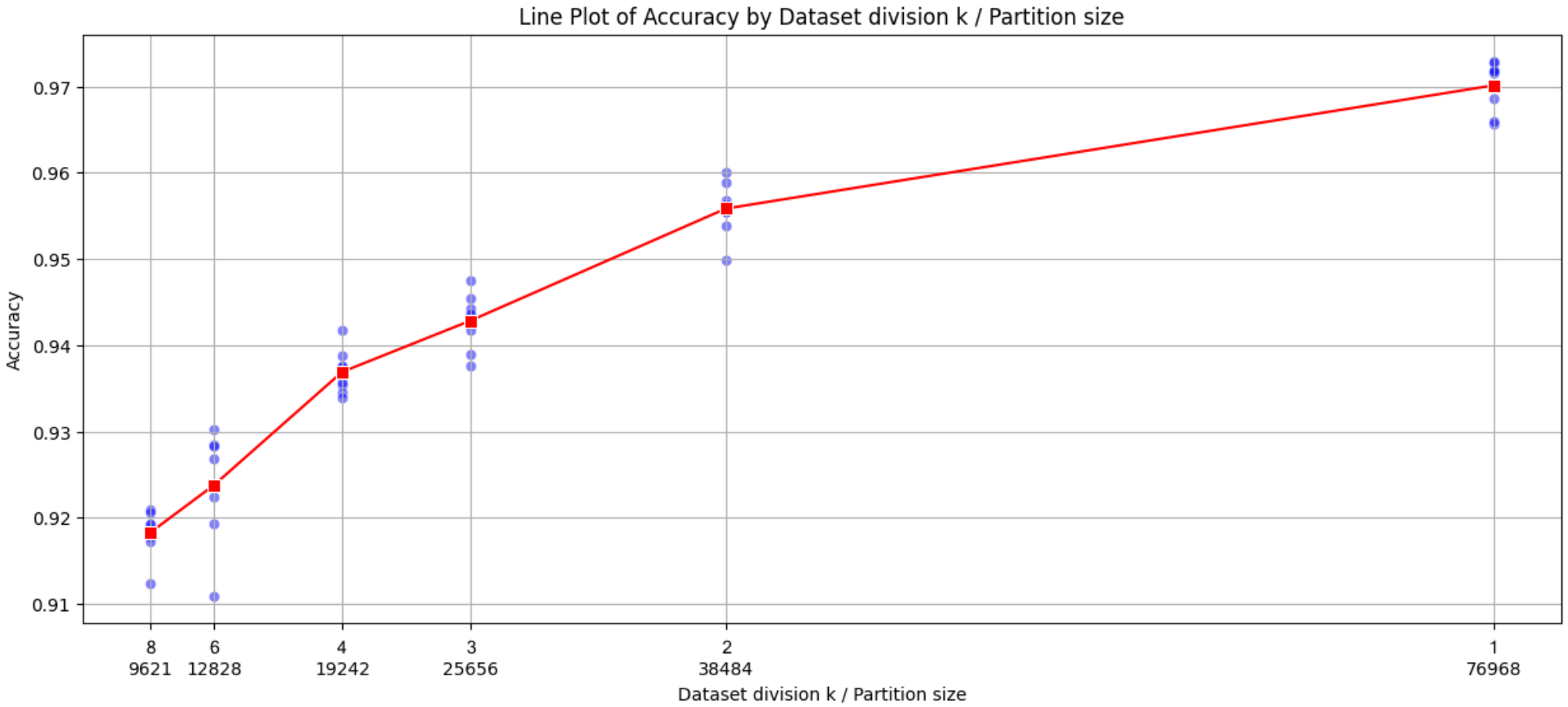

POTEŠKOĆE

- Skupovi podataka
  - Maleni datasetovi
  - Nisu javni / Prestali su biti javni
  - Varijabilnost (dimenzije, broj klasa, …)
- Normalizacija bojenja
  - Algoritam nedostupan
  - Kather (2019) stohastički proces
  - Prije ili nakon obrezivanja fotografija
- TensorFlow, infrastruktura, …

LITERATURA

I. Kather, J. et al.: "Multi-class texture analysis in colorectal cancer histology", Sci Rep, vol. 6, no. 27988, 2016.

II. Kather J. N. et al.: "Predicting survival from colorectal cancer histology slides using deep learning: A retrospective multicenter study", PLoS Med, vol. 16, no. 1, 2019.

III. Ciompi, F. et al.: "The importance of stain normalization in colorectal tissue classification with convolutional networks", in 2017 IEEE 14th International Symposium on Biomedical Imaging (ISBI 2017), Melbourne, VIC, Australia, 2017.

IV. Ghosh, S. et al.: "Colorectal histology tumor detection using ensemble deep neural network", Engineering Applications of Artificial Intelligence, vol. 100, p. 104202, 2021.

V. Martínez-Fernandez, E. et al.: "Computer Aided Classifier of Colorectal Cancer on Histopatological Whole Slide Images Analyzing Deep Learning Architecture Parameters", Applied Sciences, vol. 13, no. 7, p. 4594, 2023.

VI. Sung, H. et al.: "Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries", CA Cancer J Clin, vol. 71, no. 3, p. 209–249, 2021.

VII. Araghi, M. et al.: "Global trends in colorectal cancer mortality: projections to the year 2035", Int J Cancer, vol. 144, no. 12, p. 2992–3000, 2019.

VIII. …

PITANJA?