IMPLEMENTASI FILTER SPASIAL LINEAR PADA VIDEO STREAM MENGGUNAKAN FPGA HARDWARE ACCELERATOR



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DAFTAR ISI

DAFTA	R ISI	j
DAFTA	R TABEL	ii
DAFTA	R GAMBAR	iv
DAFTA	R LAMPIRAN	1
BAB I	PENDAHULUAN	1
1.1	Latar Belakang	1
BAB II	TINJAUAN PUSTAKA	2
2.1	Landasan Teori	2
BAB III	METODE PENENILITIAN	3
BAB IV	HASIL DAN PEMBAHASAN	4
BAB V	KESIMPULAN DAN SARAN	5
5.1	Kesimpulan	4
5.2	Saran	5
DAFTA	R PUSTAKA	5
I AMDI	DAN	ç

DAFTAR TABEL

DAFTAR GAMBAR

DAFTAR LAMPIRAN

BABI

PENDAHULUAN

1.1 Latar Belakang

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BAB II TINJAUAN PUSTAKA

2.1 Landasan Teori

BAB III METODE PENENILITIAN

BAB IV HASIL DAN PEMBAHASAN

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

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DAFTAR PUSTAKA

- Asano, Shuichi, Tsutomu Maruyama, and Yoshiki Yamaguchi (2009). "Performance comparison of FPGA, GPU and CPU in image processing". In: 2009 International Conference on Field Programmable Logic and Applications, pp. 126–131. DOI: 10.1109/FPL.2009.5272532.
- Biswas, Priyabrata (2019). *Introduction to FPGA and its Architecture*. https://towardsdatascience.com/introduction-to-fpga-and-its-architecture-20a62c14421c. Accessed on 2020-06-18.
- Castellano, G. dkk. (Jan. 2019). "An FPGA-Oriented Algorithm for Real-Time Filtering of Poisson Noise in Video Streams, with Application to X-Ray Fluoroscopy". In: *Circuits, Systems, and Signal Processing*. DOI: 10.1007/s00034-018-01020-x.
- Cheung, Peter (2019). *Introduction to FPGAs*. http://www.ee.ic.ac.uk/pcheung/teaching/ee2_digital/Lecture2-IntroductiontoFPGAs.pdf. Accessed on 2020-04-19.
- Cong, Jason dkk. (2018). "Understanding Performance Differences of FPGAs and GPUs". In: *Proceedings of the 2018 ACM/SIGDA International Symposium on Field-Programmable Gate Arrays*. FPGA '18. Monterey, CALIFORNIA, USA: Association for Computing Machinery, p. 288. ISBN: 9781450356145. DOI: 10. 1145/3174243.3174970. URL: https://doi.org/10.1145/3174243.3174970.
- Gonzalez, Rafael C. and Richard E. Woods (2001). *Digital Image Processing*. 2nd. ISBN-13: 978-0201180756. Upper Saddle River, New Jersey 07458: Prentice Hall.
- Jingbo, Xu dkk. (Aug. 2011). "A New Method for Realizing LOG Filter in Image Edge Detection". In: *The 6th International Forum on Strategic Technology*. DOI: 10.1109/IFOST.2011.6021127.
- Kerrisk, Michael (2020). (*Top*) *Linux Manual Page*. https://www.man7.org/linux/man-pages/man1/top.1.html. Accessed on 2021-02-2.
- Kowalczyk, Marcin, Dominika Przewlocka, and Tomasz Krvjak (Oct. 2018). "Real-Time Implementation of Contextual Image Processing Operations for 4K Video Stream in Zynq UltraScale+ MPSoC". In: 2018 Conference on Design and

- Architectures for Signal and Image Processing (DASIP). DOI: 10.1109/DASIP.2018. 8597105.
- Madhusudana, Pavan C. dkk. (2020). "Capturing Video Frame Rate Variations via Entropic Differencing". In: *IEEE Signal Processing Letters* 27, pp. 1809–1813. DOI: 10.1109/LSP.2020.3028687.
- Putra, Darma (2010). *Pengolahan Citra Digital*. ISBN-13: 978-979-29-1443-6. Jl. Beo 38-40, Yogyakarta 55281: Penerbit Andi.
- Raj, S.M. Alex, Rita Maria Abraham, and M.H. Supriya (Sept. 2016). "Spatial Filtering Based Boundary Extraction in Underwater Images for Pipeline Detection: FPGA Implementation". In: *International Journal of Computer Science and Information Security (IJCSIS)*. Vol. 14, No. 9.
- Rinaldi, Munir (2004). *Pengolahan Citra Digital dengan Pendekatan Algoritmik*. ISBN: 979-3338296. Bandung: Penerbit Informatika.
- S, Lars dkk. (2020). *The Linux System Adminstrator's Guide Chapter 6. Memory Management*. https://tldp.org/LDP/sag/html/vm-intro.html. Accessed on 2021-02-22.
- Sadangi, Sushant dkk. (May 2017). "FPGA Implementation of Spatial Filtering techniques for 2D Images". In: *IEEE International Conference On Recent Trends in Electronics Information & Communication Technology (RTEICT)*.
- Silbershatz, Avi, Peter Baer Galvin, and Greg Gagne (2009). *Operationg System Concepts*. ISBN: 978-0-470-12872-5. John Wiley and Sons, Inc.
- Silva, Eduardo A.B. da and Gelson V. Mendonca (2005). "4 Digital Image Processing". In: *The Electrical Engineering Handbook*. Ed. by Wai-Kai Chen. Burlington: Academic Press, pp. 891–910. ISBN: 978-0-12-170960-0. DOI: https://doi.org/10.1016/B978-012170960-0/50064-5.
- Sutoyo, T. dkk. (2009). *Teori Pengolahan Citra Digital*. ISBN-13: 978-979-29-0974-6. Jl. Beo 38-40, Yogyakarta 55281: Penerbit Andi.
- Tan, Xin dkk. (Feb. 2014). "A Real-time Video Denoising Algorithm with FPGA Implementation for Poisson-Gaussian Noise". In: *J Real-Time Image Proc.* DOI: 10.1007/s11554-014-0405-2.

- Ustyukov, Dmitry I., Alex I. Efimov, and Dmitry A. Kolchaev (June 2019). "Features of Image Spatial Filters Implementation on FPGA". In: *Mediterranean Conference On Embedded Computing (Meco)*.
- Xilinx (2020). *Field Programmable Gate Array (FPGA)*. https://www.xilinx.com/products/silicon-devices/fpga/what-is-an-fpga.html. Accessed on 2020-04-17.
- Yang, Ching-Chung (Sept. 2013). "Finest Image Sharpening by Sse of the Modified Mask Filter Dealing with Highest Spatial Frequencies". In: *OPTIK*. DOI: 10.1016/j.ijleo.2013.09.070.
- Zhao, Jin (Apr. 2015). "Video/Image Processing on FPGA". Master thesis. Worcester Polytechnic Institute.

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