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Multiscale Retinex Contrast Enhancement Algorithm for OLED Display

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Abstract:

In this project propose Multi scale retinex contrast enhancement algorithmic project for OLED Displays. All in all, MSR, that is the key component of the arranged algorithmic system, comprises of force controllable log operation and sub band astute increase administration. To begin with, we break down partner data picture to MSRs of different sub-groups, and figure a right pick up for each Multi Scale Retinex. Second, we tend to apply a coarse-to-fine power administration system, that re registers the MSRs and additions. This stride emphasizes till the objective force sparing is precisely expert. With feature groupings, the complexity levels of adjoining pictures are resolved deliberately utilizing fleeting intelligibility in order to keep away from insecure antiquities. At last, blessing numerous change abilities for information preparing. Test results demonstrate that the arranged algorithmic system gives preferred visual quality over past methods, and a predictable force sparing extent connection while not insecure ancient rarities, notwithstanding for feature successions.

Index Terms—Power consumption; contrast enhancement; OLED; multi-scale retinex

I. Introduction

Modern show panels are classified as emissive and non-emissive displays. Cathode-ray tube Plasma board and additionally the Organic light weight emitting diode square measure representative emissive displays that do not want external light sources, this will be the most desired one for the future generation. Whereas the thin-film junction transistor liquid shows (TFT-LCD) is also a non-emissive. In general, the first one is having many advantages over the second one,

Since emissive display can close up individual pixels[1] [2], it will specific complete darkness and win a high distinction quantitative relation. Second, emissive shows consume less power than non-emissive ones as a result of every component tin associate degree emissive display will be severally driven and also the power consumption of the element is proportional to its magnitude. Non-emissive displays need to activate their back light despite component intensity. Thus, the OLED is thought to be the foremost promising candidate for the next-generation show which can replace the TFT-LCD displays presently dominating the business market. So large-size OLED panels might shortly be adopted in a very wider vary of devices like high definition TV (HDTV) and radical video .Note that show modules consume most of the facility in digital media devices . Therefore techniques to attenuate power consumption within the show square measure inevitably needed. Several image process techniques for power saving in show panels are projected, on the far side circuit-level power savings. Lee et al. projected a power-constrained contrast enhancement algorithmic rule (PCCE).]They implemented an power-consumption model for OLED displays and enforced an objective operate that consists of the power terms. By reducing the target operate primarily based mostly on the bell-shaped optimization theory; they tried to simultaneously achieve distinction improvement and power savings.

The rest of this paper is organized as follows. Section II reviews a typical MSR and the SD-MSR which is a basic framework of the proposed algorithm. Section III defines a power model for OLED display and proposes a power-constrained contrast enhancement algorithm for video sequences as well as still images in detail. Section IV presents

several optimization skills for real-time processing. Section V provides intensive experimental results. Finally, Section VI concludes this paper.

II.SUB-BANDDECOMPOSEDMULTISCALERETINEX

In general, MSR, which is the key component of the proposed algorithm, consists of power controllable log operation and sub band wise gain control. First, we decompose an input image to MSRs of different sub-bands, and compute a proper gain for each MSR. Second, we apply a coarse-to-fine power control mechanism, which recomputed the MSRs and gains. This step iterates until the target power saving is accurately accomplished. Which jointly achieves contrast enhancement and dynamic range compression using an adaptive weighting strategy proper for an input image Finally, this work present a power control scheme for a constant power reduction ratio in video sequences by using temporal coherence in video sequences. Experimental results show that the proposed algorithm provides better visual quality than previous methods, and a consistent power-saving ratio without flickering

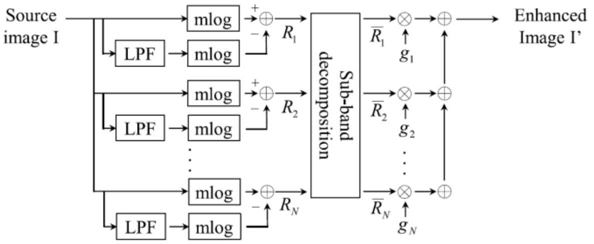

Fig 1: Block diagram of the conventional SD-MSR

artifacts for video sequences. W_L and W_H denote weighting parameters accord MSR is an extended SSR with multiple kernel windows of different sizes. MSR output is a weighted sum of several different SSR outputs. The MSR output for a single spectral component can be represented as

$$R^{MSR}(x,y) = \sum_{n=1}^{N} w_n . R_n(x,y) \qquad (2)$$

Where

$$R_n(x,y) = \log I(x,y) - \log(F_n(x,y) * I(x,y)) \quad (3)$$

Here, R_n (x, y) denotes a retinex output associated with the n-th scale for an input image $I_{(x,\, y)}$. Note that gain W_n is determined so that it can satisfy the condition of$\sum W_n = 1$. The symbol "*" in Equation 4 denotes the convolution operation and N is the number of scales. $F_n(x, y)$ denotes a surround unction and is given by

$$F_n(x,y) = K_n e^{(x^2+y^2)/\sigma_n^2} \qquad (4)$$

Where K_n is determined so that $F_n(x, y)$ can satisfy $\sum_x \sum_y F_n(x,y) = 1$.$\sigma_n^2$ Denotes the variance of the Gaussian kernel at the n-th sub-band. Under the condition $\sigma_n > \sigma_{n-1}$ for every SSR, we can derive successive frequency sub-bands. Note that a small σ_n is suitable for enhancing fine details, whereas a large σ_n is suitable for improving tonality. Thus, it is important to select an appropriate value of σ_n in the MSR. Based on this rationale, Jang et al. proposed an SD-MSR that consists of a modified logarithmic function, sub-band decomposition, space varying sub-band gain, and an automatic gain/offset control. The modified log (m log) is defined as

$$m\log\big(I(x,y)\big) =$$
$$wL\log Ix,y+1 \qquad Ix,y \le \tau - wH\log D - Ix,y + \log D$$
$$Ix,y > \tau \qquad (5)$$

where τ is a user-defined threshold and D denotes an image dynamic range. For example, D is 256 for an 8-bit image.

ing to τ and are defined as

$$w_L = \frac{\frac{\tau}{D-1}\log D}{\log(\tau+1)}, \qquad (6)$$

$$w_H = \frac{(1-\frac{\tau}{D-1})\log D}{\log(D-\tau)} \qquad (7)$$

As a result, the $m$log function of Eq. (7) enhances the contrasts of dark regions as well as bright regions. In this way, this work can enhance image details both in highlights and shadows. Another feature of SD-MSR is to decompose the modified retinex outputs into nearly non-overlapping spectral bands. The following equation accomplishes this sub-band decomposition:

$$\overline{R_1} = R_1, \qquad n=1$$
$$\overline{R_1} = R_n - R_{n-1} \quad 2 \le n < N \qquad (8)$$

As n increases, R_n corresponds to the low frequency region more and more. Here, Rn is computed by replacing the log of Eq. (5) with the $m_{\log}$ of Eq. (7) next, the space varying sub-band gain at the n-th subband is defined as

$$g_n(x,y) = \left(\frac{1}{NR_n(x,y)+\varepsilon_g}\right)^{1-\frac{\sigma_n}{\sigma_{max}+\varepsilon_\sigma}} \qquad (9)$$

Where $\sigma_{\max}$ = max $n \in \{1,2,...,N\}$ σ_n. Also, E_g and E_σ are two constants to avoid dividing by zero. In this paper, εg and $E\sigma$ are set to0.1 and 0, respectively. NRn denotes the normalized SSR at the n-th sub-band and is defined as

$$N\,R_n(x,y) = \frac{\overline{|R_n(x,y)|}}{|\overline{R_n}|_{max}} \qquad (10)$$

Where $|\overline{R_n}|_{max}$ = max R_n In a high spectral band of small n, they make the gain difference between pixels larger, especially for the pixels with low $NR_n\,(x, y)$. This is because this spectral band has large high-frequency components representing image details. Meanwhile, they lower the gain difference between pixels in a high spectral band of large n to maintain the characteristics of a natural scene. Thus, using Eq. 10, the final enhanced image $I\_$ is output as follows:

$$I' = \sum_{n=1}^{N} g_n \bar{R}_n \qquad (11)$$

III.THE PROPOSED SYSTEM

In this propose a power constrained enhancement algorithm for OLED show primarily based on SD-MSR. Fig.2 describes the projected formula that consists of three stages. the primary stage coarsely reduces the power of an input image nearer to the target power with distinction improvement, and the second stage finely controls the image power such that it is so near to the target power. If the input is a video sequence, the ultimate stage adjusts the power of every image so that it is likely those of its neighbors by considering the temporal coherence of the input video sequence. The projected formula is differentiated from previous methods in the following aspects. First, to control the target power level mechanically. Second, to avoid the flickering process by keeping the facility levels of adjacent images constant for video sequences. Third, to achieve real time process of the projected formula on a general purpose graphics process unit (GPU) even for full HD video sequences.

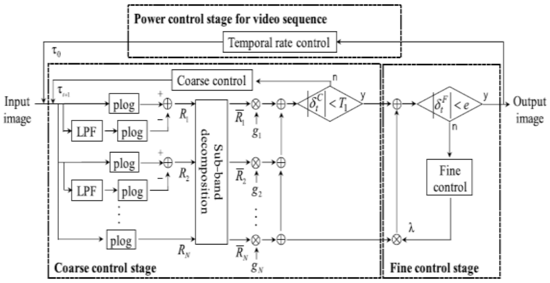

Fig 2: Block diagram of the proposed SA-MSR**.**

A. *Power Modeling in OLED Display*

Before presenting an in depth clarification of the projected algorithmic program, we want to model power for associate OLED. Dong et al. conferred a pixel-based power model that estimates the ability consumption of OLED modules supported the red green-blue (RGB) specification of every pixel. the ability consumption of associate OLED with K pixels, i.e., P is

$$P_{OLED} = C + \sum_{i=1}^{k} \{f_R(R_i) + f_G(G_i) + (f_B(B_i)\}$$

where $f_R(R_i\;)$, $f_G(G_i)$, $f_B(B_i)$ indicate the power consumption of red, green, and blue devices of the pixel, respectively and i stands for the pixel index in an image. C is a constant to account for the static power contribution made by the non-pixel part of the display, which is independent of the pixel values. In this paper, the constant C is not considered for convenience. Also, we consider only the Y-component because it dominates the entire overall power. Note that the Y-component indicates the luminance component in YUV color format. So we use the Y-component power consumption (YP) of an OLED display with K pixels.

$$YP = \sum_{i=1}^{k} y_i^{\gamma}$$

IV.ALGORITHM

A. Coarse Control Stage:

The $m$log of conventional SD-MSR plays a role in enhancing the contrasts of highlight and shadow regions. In other words, contrast in the dark region becomes high by increasing the intensity level of the pixels in the region, and contrast in the bright region also becomes high by decreasing the intensity level of the pixels in the region. However, the increase of the intensity values in the shadow region results in the increase in power consumption for the OLED display. So, for low power consumption as well as contrast enhancement, even in the shadow region, so-called power-constrained log ($p$log) from the $m$log of Eq. (4) as follows:

$$\boldsymbol{P_{log}(I(x,y))} = \begin{cases} \frac{\boldsymbol{\tau log D log(\alpha I(x,y)+1)}}{\boldsymbol{(D-1)log(\alpha\tau+1)}} & \boldsymbol{I(x,y) \le \tau} \\ \boldsymbol{mlog(I(x,y)I(x,y)} > \tau \end{cases} \qquad \textbf{(12)}$$

Therefore, the plog of Eq. (12) has the effect of controlling the increase in power consumption while partially lowering the contrast in the dark region. If the input is a video sequence there would be another stage in this algorithm that is Power Control Stage for Video With image sequences, the τ parameter for the current image can be derived from that of the previous image because of high temporal correlation. So, if we know the power reduction ratio of the previous image in advance, we can determine the increase and decrease in τ for the current image. Based on his concept, we determine τ0 of the next image, i.e., τ0,next from τ0 of the current image according to . This helps the CCS in rapidly converging with a reduced number of iterations for video sequences. Since a significant change of τ0 between adjacent images may cause flickering artifacts due to contrast fluctuation, we limit τ0,nextto [τ0-5, τ0+5].

VI EXPERIMENTAL RESULTS

The simulation of the proposed algorithm for an image is given in figure(3).There we compared the proposed algorithm with a typical linear algorithm and a power-constrained contrast enhancement proposed in terms of qualitative visual quality. First, Fig (3) is the results of several algorithms for the caps image when P is 10%. Both the proposed algorithm and the PCCE achieve significant contrast enhancement compared to the linear algorithm. However, the PCCE loses the details in the yellow cap and shows too darkened shadows as seen in Fig.3(c).the proposed algorithm can enhance details while effectively preserving the overall intensity level of the input image .Figure(5) represents the power reduction ratios for a video sequence .We can observe that the proposed algorithm shows consistent power reduction ratio values, irrespectively of frame numbers. On the contrary, the PCCE causes significant fluctuations. Figure(3) is The p log function according to α values in CCS.

Fig 3: Input image & Gray Scale Image

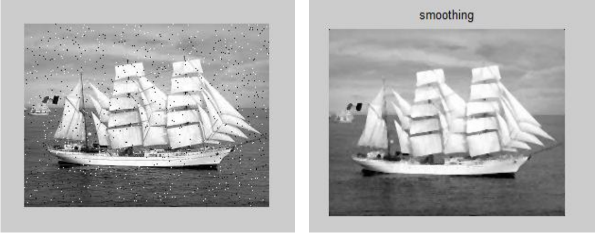

Fig 4: Salt and pepper noise & smoothing image

Fig 5: Output image

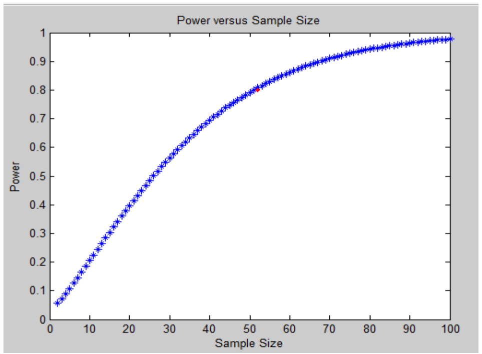

Fig 6: Performance of Power and sample size

6.2 PERFORMANCE EVALUATIONS OF PROPOSED SYSTEM

6.2.1 Comparison Of The Edge Preservation Ratios

S.N	**Name**	**P=10%**		**P=30%**	
		Pcce	**Proposed**	**pcce**	**Proposed**
1.	**Big ship**	**1.41**	**2.9**	**1.19**	**3.2**
2.	**Bus**	**1.02**	**1.51**	**088**	**1.71**

6.2.2 Comparison In Terms Of The EME Value

S. N	**Name**	**P=10%**		**P=30%**	
		PCCE	**Proposed**	**PCCE**	**Proposed**
1.	**Big ship**	**48.0**	**73.07**	**44.21**	**82.20**
2.	**Bus**	**79.13**	**87.83**	**72.02**	**84.25**

6.2.3 Comparison In Terms Of Sharpness Enhancement Metric

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s.n	Name	P=10%		P=30%	
		PCCE	Proposed	PCCE	Proposed
1.	Big ship	6.12	7.23	5.71	9.04
2.	Bus	5.03	6.12	4.84	5.23

The Comparison Of Flickering Artifacts In Terms Of The F Value

	Name	PCCE			Proposed		
		SN	SF	Q	SN	SF	Q
1.	Big ship	1.00	0.99	0.99	1.7	1.97	1.75
2.	Bus	0.02	0.99	0.81	0.90	1.02	0.90

The Output Power Reduction Ratios for Various *P* Values

	Name	Target Power P				
		10%	30%	50%	70%	90%
1	Big ship	11.07	31.03	53.23	71.2	91.2
2	Bus	10.05	32.5	58.26	75.56	96.56

In Video Sequences

Figure 7:Input Video

	Name	Proposed
1	Video	0.01

Figure 8:Output Video

The Comparison of Flickering Artifacts

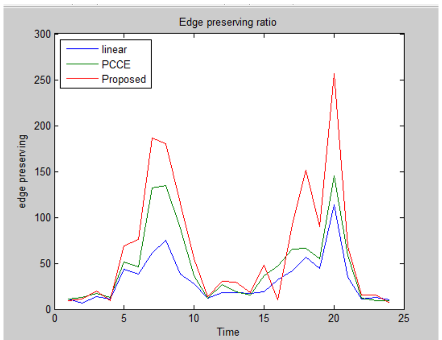

Figure 9: Average Performance of Edge preserving and Time

VI .CONCLUSION

This project proposes an SD-MSR-based image processing algorithm for fine power control in OLED displays. In this designed a power-constrained log function for effective power saving in dark regions. Using the power-constrained log function for SD-MSR and an adaptive weighting strategy proper for an input image, we proposed a coarse-to-fine power control mechanism for still images. Finally, we presented a power control scheme for a constant power reduction ratio in video sequences by using temporal coherence in video sequences. Experimental results showed that the proposed algorithm provides better visual quality than previous works, and a consistent power-saving ratio without the flickering artifact even for video sequences. Specifically, the proposed algorithm provides at maximum 36% and on average 13% higher edge-preserving ratios than the state-of-the-art algorithm. In addition, we proved the possibility of real-time processing by accomplishing an entire execution time of 9 ms per 1080p image.

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