

# Entropy Based Threshold Selection for Melanoma Image Segmentation

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**Abstract** - Image segmentation great is generally ruled through key parameters related to a specific segmentation approach: threshold desire and seed-point selection. Various methods in conjunction with the histogram approach, entropy-primarily based method, busyness measure techniques were used. Various methods are broadly identified for threshold choice in the photo segmentation issues. In this article, a way for epidermis melanoma segmentation, which type of preserves the cancer component in great segments, is provided. In the proposed method, threshold determination in cancer snapshots is completed at the inspiration of entropy measures including the Shannon, Renyi, Havrda-Charvat, Kapur and Vajda entropy measures. Simulation results of photograph segmentation are making use of correct entropy measures also are stated with a comparative proof.

**Key Words:** melanoma, segmentation, benign, malignant

## 1. INTRODUCTION

When a kind of disease which likely conceivable is distinguished, it's miles related to the user guide of the minute test of a tissue design. Malignant growth is most generally dealt with radiation cure, chemotherapy, and careful treatment. The potential outcomes of enduring the ailment go normally expressway of the design and area of most malignant growths and the amount of disease toward the beginning of treatment. Melanoma can affect ladies and men of each of the long haul, paying little respect to the way that a couple of sorts of most extreme diseases are more prominent right in youngsters, furthermore, the possibility of developing greatest malignant growths greatest will develop with age.

At the point when most tumours start propelled, it continually delivers no signs and side effects. The various signs and signs and indications and signs and manifestations best show up in view of reality the mass keeps up to develop or ulcerates. Steady with the impact of the discoveries rely on the assortment and region of most extreme malignant growths. Scarcely any signs are focused, with masses of them besides most usually taking zone in givers who've uncommon circumstances. Malignant growth is the most recent "extraordinary imitator." Consequently, it isn't special for people determined to have the disease to had been managed for various illnesses to which it was expected their indications and manifestations have been expected [1].

Neighbourhood signs can likewise totally ascend because of the mass of the tumour or its ulceration. For example, the mass results from lung malignant growth can reason blockage of the bronchus essential to a hack or pneumonia; oesophageal disease can reason narrowing of the throat, making it extreme and excruciating to swallow; and colorectal disease may also completely bring about narrowing or blockages inside the

entrails, following in changes in gut lead [2]. General signs and manifestations and side effects stand up because of methodologies away outcomes of the melanoma that are not concerning immediate or metastatic spread. These can likewise need to include: unintended fever, weight reduction, exorbitantly exhausted, and modifications to the dermis [3]. Hodgkin sickness, leukemia, and tumors of the liver or kidney can reason an incessant fever of obscure starting territory. Segmentation is a very vital step in detecting the malignancy of a sample.

## 2. LITERATURE REVIEW

The significant commitments in the related field are arranged as underneath:

A. Cohen and A. Lapidoth [4] Investigated a measure of circle identification calculations like popular Hough form into, Gerig and Klein Hough change into (GKHT) and quick Hough become which had been situated on varieties of the Hough change into. They while put next explicit generally speaking execution homes reminiscent of exactness, computational effectiveness, unwavering quality, and carport prerequisites. The aftereffects of being instructed shown that the GKHT experienced serious inconvenience whenever used to dangerous photos. The essential deterrent of the GKHT was the untrustworthiness and espresso effectivity considering that side way aptitude transformed into now not secured in this method.

S Cohen, et al., [5] Provided a chose total of adjustments to the round Hough transforms into (CHT) with scale invariant piece administrator. Creators broke down that the tallness width inside the yield circle discovery exhibit in the nearness or nonattendance of commotion, and assessment of the zenith job in expressions of creating clamor degrees. Results demonstrated that CHT had improved clamor resilience.

D. Karakos and A. Papamarcou [6] Awarded an incredible randomized circle recognition set of tenets utilizing Hough end up. It was before an advanced 'contraption for picking broadened design focuses on the legitimacy and discovering applicant circles. Trial last outcomes inspected that the proposed set of tenets had a high determination and solid strength, forestalls false circle location and furthermore pertinent for oval identification.

R. Dugad, et al., [7] Proposed an attainable framework for tallying of wheat ears utilizing shading and surface assessment. For ear extraction, way calculation winds up utilized thinking about that it was when smooth to put into impact and offer better surface stratification. For checking affect improvement, each grayscale of the image used to duplicate by means of the assessment, which lets in to widen

the pleasant forces of ears and to bring down the powerless powers like soil, branches, and leaves. Considering as soon as completed by means of three photograph preparing techniques wherein the primary contraption used to be first request actualities, second

transformed into when co-event lattice and last was run length process. Run length gave the greatest reliable results among 3 and it used to almost control depend upon.

N. Merhav [8] assessed winery yield with the guide of identifying grape berries routinely and non-ruinously utilizing pictures caught from cars driving digicam along vineyard lines.

Anelia Somekh-Baruch, et al., [9] offered a calculation that checks the number of pomegranates on the tree using close camera pictures. Shading and shape examination gave all the more powerful outcomes and straightforwardness in usage. In radiant days, strips of pomegranate and leaves show additional sunlight so proposed calculation has versatile edge value that was once used to the pictures steady with the variable light. In the twofold picture in the wake of thresholding, circles have been furnished and their geometric offices have been checked which were equivalent to the quantity of evaluated natural products.

Y. Steinberg and N. Merhav [10] confirmed yield forecast of grapevine which furthermore appropriate for most essential types of the harvest. The accumulation of previews had been practiced using a contract from-development module to recapture a thick and shaded 3-D renewal of the scene. The recommended gadget finished a mix of shape highlights and shading adaptation for grapevine extraction. Trials demonstrated that green grapes (going before to maturing) having an exactness of 0. Ninety-eight and precision of 0.96 for changing shading grapes.

### 3. PROPOSED METHOD

In the dilemma of region of interest extraction, we speak the wonderful entropy measures which is used in this thesis for a comparative benefit to know exactly what problems arises in image segmentation. The method of image segmentation the use of the gray level coincidence matrix () And Shannon entropy degree is discussed. In this thesis, we amplify this technique utilizing the coincidence matrix with no- Shannon entropy measures (paying homage to Renyi, Havrda-Charvat, Kapur and Vajda entropy) on coloration photographs. The primary steps of the set of rules are reproduced right here for the sake of comfort:

1. First of all, the co-prevalence matrix of the photo to be segmented is computed for every color channel.
2. The probability distribution is then calculated from its co-occurrence matrix.
3. Entropy feature for each entropy definitions, as defined beneath, are then calculated for each for a given photograph to be segmented using the probability distribution.
4. The numbers of minima factors are decided from the entropy characteristic as opposed to gray level () plot. The gray and color factor degree similar to the smallest minima may be taken as a threshold for picture segmentation troubles.

Next, we discuss distinct entropy measures, which are used in this work, a comparative takes a look at in photograph segmentation problems.

#### Shannon Entropy:

$$\text{Entropy}(t) = \sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} p_{m_1, m_2} \log p_{m_1, m_2} - \sum_{m_1=t+1}^{L-1} \sum_{m_2=0}^t p_{m_1, m_2} \log p_{m_1, m_2}$$

#### Kapur Entropy:

$$\text{Entropy}(t) = \sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} \left\{ \frac{p_{m_1, m_2}^{\alpha+\beta-1}}{p_{m_1, m_2}^{\beta}} - 1 \right\} (2^{1-\alpha} - 1)^{-1}$$

#### Vajda Entropy:

$$\text{Entropy}(t) = \left\{ \frac{\sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} p_{m_1, m_2}^{\alpha}}{\sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} p_{m_1, m_2}} - 1 \right\} (2^{1-\alpha} - 1)^{-1}$$

#### Renyi Entropy:

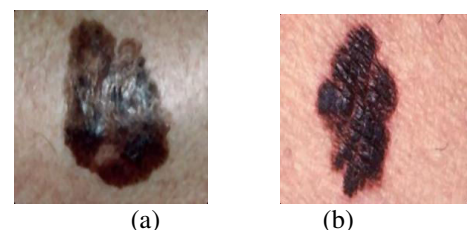
$$\text{Entropy}(t) = - \sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} \frac{\log(\sum (p_{m_1, m_2})^{\alpha})}{1-\alpha} - \sum_{m_1=t+1}^{L-1} \sum_{m_2=0}^t \frac{\log(\sum (p_{m_1, m_2})^{\alpha})}{1-\alpha}$$

#### Havrda-Charvat Entropy:

$$\text{Entropy}(t) = \frac{1}{2^{1-\alpha} - 1} \left\{ \sum_{m_1=0}^t \sum_{m_2=t+1}^{L-1} p_{m_1, m_2}^{\alpha} - 1 \right\} + \frac{1}{2^{1-\alpha} - 1} \left\{ \sum_{m_1=t+1}^{L-1} \sum_{m_2=0}^t p_{m_1, m_2}^{\alpha} - 1 \right\}$$

### 4. SIMULATION RESULTS AND ANALYSIS

In this chapter, we present the simulation results performed in MATLAB on the melanoma images. The test images considered for investigation are shown in Fig. 4.1. The entropy of these images are computed using entropy versus gray level plot obtained for different definition of entropy and the plots are evaluated for ease of reference. The images are then segmented by smallest minima obtained from the entropy function versus gray level plot as shown by Fig. 4.1, where gray tone monotonically increases in horizontal axis and corresponding entropy value is plotted along vertical axis. Obtained simulation results are shown in Fig. 4.2.

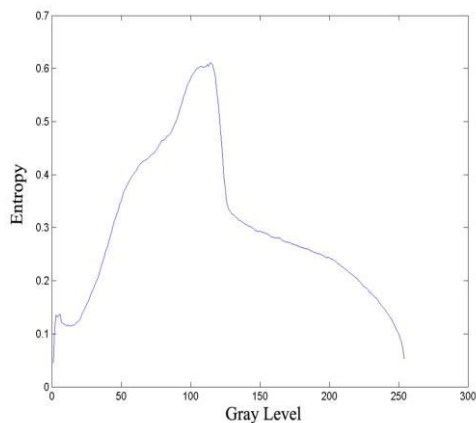


**Fig - 4.1:** Melanoma Images Under Investigation (left for benign and right for malignant)

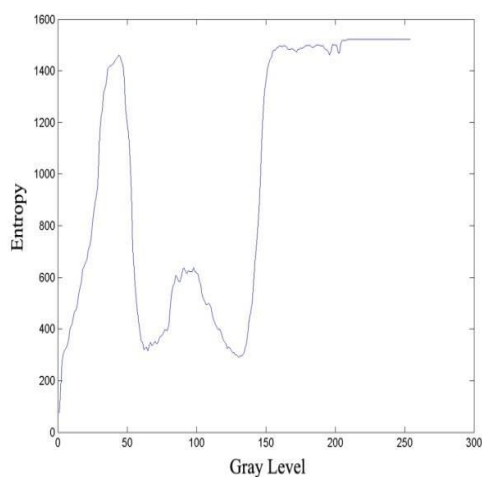
It is obvious from fig 4.1 that benign samples are round in shape with minimal asymmetry, border irregularity, color variegation and minimal size as compared to the malignant samples. The patch is positioned in the centre of the image while the neighborhood region depicts the shaved healthy skin region. In order to diagnose the sample, it is mandatory to process the images through a segmentation mode, which can binarize the input image. The binarized images needs to bears a binary one at the location pod patch while vice versa for healthy skin region.



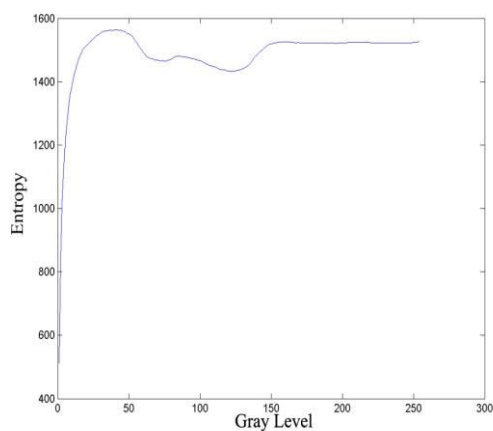
(a) Sample Image



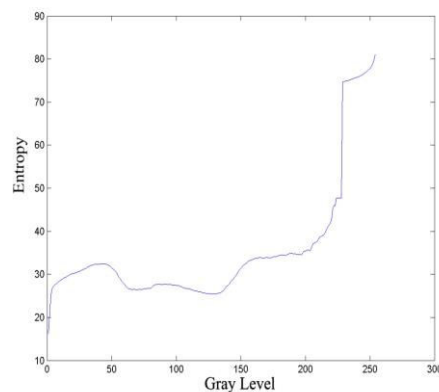
(b) Shannon Entropy



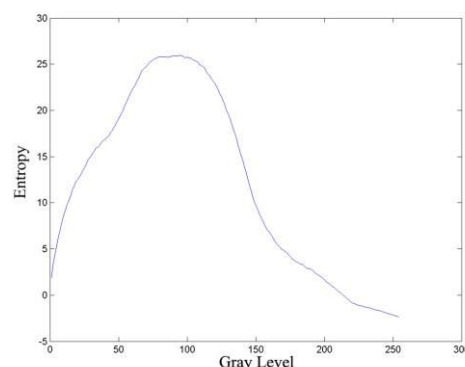
(c) Kapur Entropy, For  $\alpha = 0.5, \beta = 3$



(d) Vajda Entropy, For  $\alpha = 2, \beta = 1$



(e) Renyi Entropy, For  $\alpha=2$



(f) Havrda-Charvat, For  $\alpha=0.5$

**Fig - 4.2:** Entropy v/s Gray level plot for threshold selection benign melanoma images

The previous session depicts the model for image segmentation using entropy measures. Various Shannon and non-Shannon entropy models are needed to be investigated for their performance to diagnose the melanoma. Shannon, Havrda-Charvat, Kapur, Vajda and Renyi function are deployed.

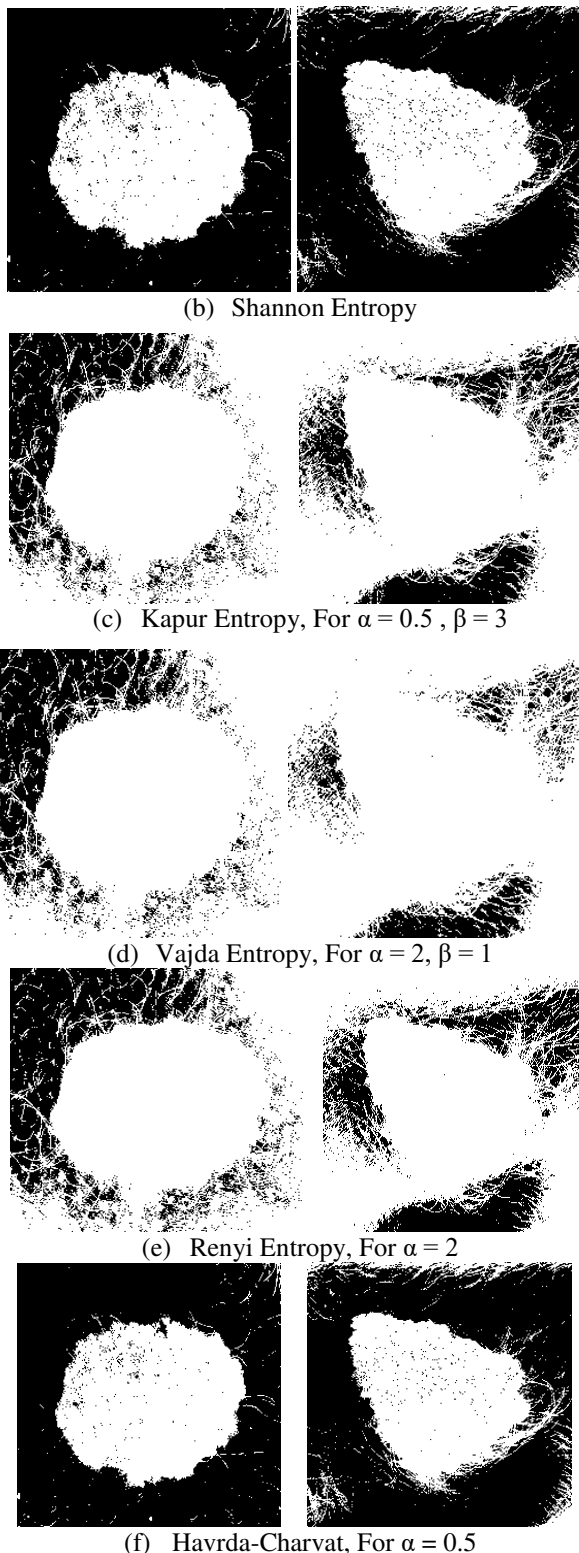
In the gray level versus entropy plot, it is important to notice that location of regional minima represent the optimum threshold required for the binarization. The minimal in the entropy plot resembles the region of maximal information being retrieved at the selected threshold value.

For each of these entropy plots, the justifiable threshold value for image segmentation can be selected as the minimal regional minimum point. Regional minima can be defined as the regional description of such set of point which is minimum in its own locality and the values ahead and behind are maximum in comparison to it.



(a) Image Sample





**Fig - 4.3:** Original images & entropy based segmentation results for different segmentation approach for first pair

Horizontal co-ordinate of minimal regional minima will correspond to gray tone binarization point  $T$ .

The gray level at which minimal regional minima of entropy plot is located as the desired threshold.

Hence desired threshold can be optimally located at the instance of minimal regional minima. This phenomenon is observed for all the investigated entropy functions of Shannon, Renyi, Kapur, Havrda-Charvat and Vajda. In an order to

determine the best entropy function among these, it needs to investigated the binary results and compare their outcomes to decide an optimum entropy based approach for melanoma segmentation as shown in Fig. 4.3.

## 5. CONCLUSION & FUTURE SCOPE

In this thesis, we have got investigated the hassle of threshold choice in melanoma image segmentation, and quantitative evaluation of the high-quality of the entropy measures to extract out the tumor from a given cancer images. Right threshold selection is a difficult mission in photo segmentation problems. A variety of entropy measures for threshold choice motive in gray and shade photo segmentation issues are studied. Threshold willpower is finished by extraordinary entropy measures on cancer graphics. Comparative evaluation of the Shannon and non-Shannon entropies (Renyi, Havrda-Charvat, Kapur and Vajda) is completed to gather a right threshold fee for the motive of lesion segmentation. So finally, from the result section we conclude that Havrda-Charvat entropy measure is best than the rest entropies.

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