

# PROCESSING OF IMAGES TO PREDICT AGE AND WEATHER IMPACT ON WOOD

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## ABSTRACT

*Processing of cross sectional view of a wood that predicts the age and its weather impact by using convolution theorem and SVM classifier. The cross sectional view of a wood (X-Ray image) is extracted from the tree and it is given as an input. Image is processed and converted into gray scale image in order to remove the noise which present in the cross sectional view of an image. The extracted image is converted into vector. Vector contains many tree ring structure, distance between two tree ring structures is predicted using distance calculation. Input image is matched with the trained image. Image stored in the database is classified using SVM classifier based on the distance between two tree ring structures. If the input image matches with trained image, it will retrieve age, weather impact and outer layer thickness of the wood. The distance between two tree ring structure is used to classify and analyze age, weather impact and outer layer thickness of the wood by using SVM classifier. In the existing system two layered laminated wood is taken and processed. The laminated wood is pre-processed and it leads to wastage so the quality of wood cannot be predicted accurately. Two layered laminated wood contains more processing which is time consuming.*

**Key words**— X-ray images, Support Vector Machine classifier, Convolution theorem, Vector, Euclidian distance, Tree ring structure.

## 1. INTRODUCTION

The grain of the two laminates is parallel. Such a product has high surface hardness due to the use of densified wood and can be fabricated at a lower cost than a symmetric, three-layer laminated wood product (i.e., D–V–D). One of the application two-layer laminated wood product is flooring. However, warp of such an asymmetric laminated wood product (e.g., cup, crook, and bow) would appear due to its asymmetric structure in both material properties and geometric profile, causing a critical issue that significantly degrades the appearance quality of its end-products. Considering the laminated wood product, cupping in the cross-section of the layered system is the most probable type of warp because of larger swelling/shrinkage coefficient differential between two wood layers in the transverse direction than the longitudinal (L) direction. The degree of cupping varies with the fluctuations of the surrounding temperature and moisture, which is defined as the distance from one top point to the line linked by two end points of a convex curve. Cupping in strip hardwood floor board shall not exceed 1.58 mm (1/1600) in height in a 76.20 mm (300) maximum span measured perpendicular to the long axis of the board. The Measures of the cupping values of three types of three-layer cross-laminated and two types of two-layer cross-laminated wood flooring using a dial gauge. The cupping of two-layer cross laminated wood flooring was larger than that of three layer wood flooring.

In the existing system CT scanner images are used. Binary map is used for computation which increases the complexity. It fails to predict the life span and weather impact on wood. The quality-related wood properties that should be monitored, density and moisture content are two of the most important because they affect the efficiency of manufacturing processes. For example, moisture content should be known to optimize the drying process or log inventory management. Density is related to stiffness and can be used to maximize fiber quality when bucking. Also, knowledge of the position and size of internal log defects, such as knots and decay, is required for optimizing log sawing that brings lumber value improvement, ranging from 3% to 28% depending on the species. To accurately control product quality before or during processing, there is the need of nondestructive real-time scanning of both the macroscopic and microscopic structure of wood properties. Currently, there are several nondestructive technologies that use X-ray, gamma-ray, neutron, optical (visible and near- or shortwave infrared), thermal infra-red, microwave, ultrasound, radiofrequency, and magnetic resonance radiations. To reach deep wood layers, the

radiation should have either a wavelength that is long enough or an energy that is high enough to penetrate the material. Microwave, ultrasound, and magnetic resonance radiations have wavelengths that are long enough (on the order of 10–2 m) to penetrate the wood material, but at the same time, they are not able to detect microscopic wood structures.

In the proposed system cross sectional view of the wood is taken and analyzed. The aim of the study is to find out age, weather impact and outer layer thickness. This approach can be implemented by using SVM (Support Vector Machine) classifier model. Initially, set of related images are trained into the database. This model is used to analyze and classify the pattern from the image. This extracted pattern will be matched with the trained images in database. Finally, similar images are retrieved and displayed as output. In addition, it determines the life span of the wood, weather impact on the wood, thickness of outer layer of the wood, and finding out whether the wood is useful or not, if there is any crack in the wood. This weather prediction works based on distance calculation. Our system use Euclidian distance calculation. Hence, our proposed work overcomes the drawback of existing system and results in high efficiency and performance in low cost.

## 2. EXPERIMENTAL MODULE

In this, cross sectional view of the wood and its ring structure is taken and analyzed. This approach can be implemented by using SVM (Support Vector Machine) classifier model. Initially, set of related images are trained into the database. This model is used to analyze and classify the pattern from the image. This extracted pattern will be matched with the trained images in database. Finally, similar images are retrieved and displayed as output. In addition, it determines the life span of the wood, weather impact on the wood, thickness of outer layer of the wood, and finding out whether the wood is useful or not, if there is any crack in the wood.

### 2.1. Image Pre-processing

Generally, the captured x-ray image is given as an input. It has various type of noises. Those noises affects the edge detection accuracy in the wood image. The color image consists of three combination Red, Green, Blue. In Matlab, if any image is given as an input, it is stored as a matrix format and matrix consists of number of rows and number of columns. Processing of color image is difficult so we are converting the color image into a grayscale image in order to reduce the noise. There are many inbuilt filters in MATLAB like median filter, standard deviation filter, averaging filter etc. In this work, we are using median filter to remove the noise. The median filter is a nonlinear digital filtering technique, used to remove noise. Such noise reduction is a typical preprocessing step to improve the result of later processing (for example, edge detection on an image). It preserves edges while removing noise.

The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. In pre-processing, the two data formats (\*.avi and \*.jpg) are most convenient for data processing.

- 1) Loading and showing a sequence of cross sectional view of wood images previously saved in the folder in \*.jpg format to Matlab can be done using the following code:

The matlab command for reading an image is,

```
>> imread('filename');
```

Note that we suppress the output with a semicolon, otherwise we will get in the output all the numbers that make the image. 'filename' is the name of a file in the current directory or the name of a file including the full path.

```
>> f = imread (*.jpg);
```

We now have an array f where the image is stored.

To display the image we use *imshow*

```
>> imshow(f);
```



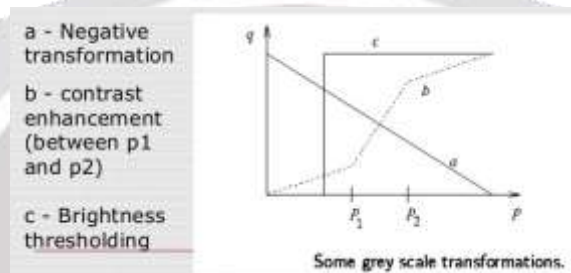
- 2) Immediately loading the image into Matlab, the image is converted into grayscale image, because the image noise may be termed as random variation of brightness or color information.

The Matlab command for converting a color image into grayscale image is,

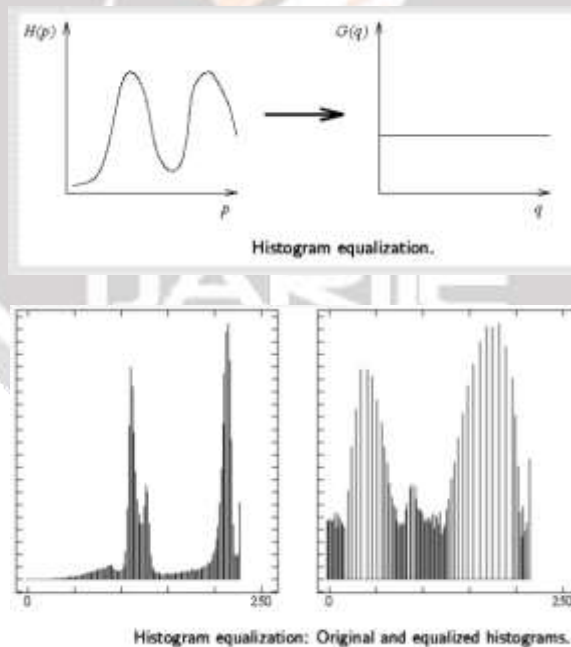
```
>> img = rgb2gray(f);
```



Grey scale transformations can be performed using look up tables. These transformations are mostly used if the result is viewed by a human.



Typical grey level transform... histogram equalization is usually found automatically



- 3) Canny edge detection requires some method of filter out any noise and still preserve the useful image. Convolution is a simple mathematical method to many common image-processing operators.

I <sub>11</sub>	I <sub>12</sub>	I <sub>13</sub>	I <sub>14</sub>	I <sub>15</sub>	I <sub>16</sub>	I <sub>17</sub>	I <sub>18</sub>	I <sub>19</sub>
I <sub>21</sub>	I <sub>22</sub>	I <sub>23</sub>	I <sub>24</sub>	I <sub>25</sub>	I <sub>26</sub>	I <sub>27</sub>	I <sub>28</sub>	I <sub>29</sub>
I <sub>31</sub>	I <sub>32</sub>	I <sub>33</sub>	I <sub>34</sub>	I <sub>35</sub>	I <sub>36</sub>	I <sub>37</sub>	I <sub>38</sub>	I <sub>39</sub>
I <sub>41</sub>	I <sub>42</sub>	I <sub>43</sub>	I <sub>44</sub>	I <sub>45</sub>	I <sub>46</sub>	I <sub>47</sub>	I <sub>48</sub>	I <sub>49</sub>
I <sub>51</sub>	I <sub>52</sub>	I <sub>53</sub>	I <sub>54</sub>	I <sub>55</sub>	I <sub>56</sub>	I <sub>57</sub>	I <sub>58</sub>	I <sub>59</sub>
I <sub>61</sub>	I <sub>62</sub>	I <sub>63</sub>	I <sub>64</sub>	I <sub>65</sub>	I <sub>66</sub>	I <sub>67</sub>	I <sub>68</sub>	I <sub>69</sub>

K <sub>11</sub>	K <sub>12</sub>	K <sub>13</sub>
K <sub>21</sub>	K <sub>22</sub>	K <sub>23</sub>

An example small image (left), kernel (right)

- 4) Convolution operation is performed by sliding the kernel or mask over a grey-level image. It is useful for blurring, sharpening, edge detection and more.

The kernel starts from the top left corner and moves through entire image within image boundaries. Each kernel position corresponds to a single output pixel. Each pixel is multiplied with the kernel cell value and added together.

Example for pixel value at position 57 below:

$$O_{57} = I_{57}K_{11} + I_{58}K_{12} + I_{59}K_{13} + I_{67}K_{21} + I_{68}K_{22} + I_{69}K_{23}$$

Mathematically we can write:

$$O(i, j) = \sum_{k=1}^m \sum_{l=1}^n I(i+k-1, j+l-1) K(k, l)$$

The output image will have M-m+1 rows and N-n+1 columns, M image rows and N image columns, m kernel rows and n kernel columns.

The output image will be smaller when compared to the original image. This is due to the bottom and right edge pixels, which can't be completely mapped by the kernel therefore m-1 right hand pixels and n-1 bottom pixels can't be used.

## 2.2. Edge Detection

In this module, detecting all edges of wood image using a canny edge detection that produces a binary edge map. Then, extracting all edges from the edge detected image using a curvature scale space method. Next, calculating the curvature at a fixed low scale for each edge to retain the true end points, and regarding the local maxima of absolute curvature as end point candidates. Finally, determining a threshold adaptively according to the mean curvature within a region of support, and removing bad end points by comparing the curvature of end point candidates with the adaptive threshold.

MATLAB provides a general edge detection command that is sensitive to horizontal or vertical edges or both. The general syntax for this function is

$$g = \text{edge}(f, 'method', parameters)$$

where  $f$  is the input image,  $method$  gives to the edge detection algorithm used, and  $parameters$  gives the parameters that accompany the algorithm.  $g$  is binary image where edges have a value of 1.

The most powerful edge detector is the Canny edge detector provided by the function  $edge$ . The Canny edge detector incorporates information about the direction of the image gradient in determining whether a given pixel is an edge pixel. It also has two thresholds, a weak threshold  $T_1$  and a strong threshold  $T_2 > T_1$ . The Canny edge detector gives good edge detection for biological images, which are typically noisy and have less well-defined edges.

$$BW = \text{edge}(I, 'canny', THRESH, SIGMA)$$

Where  $THRESH$  is a two element vector in which the first element is the low threshold, and the second element is the high threshold.  $SIGMA$  is the standard deviation of a Gaussian filter that is applied to the image prior to edge detection.

The fundamentals of the algorithm for locating the edges are briefly described as follows:

- 1) Apply the Canny edge detector to the grey level image and obtain a binary edge map.



- 2) The canny edge detector first smoothers the image to eliminate noise.



#### Image Segmentation using the Canny method

- 3) In this case, the median filter is the best option due to its characteristics, mainly the ability to remove noise. Median filter, which has its own implementation in Matlab. Matlab also has a function to generate noise in an image. We will see how to corrupt an image (with `imnoise`) and how to try to restore it with a median filter.
- ```
g = medfilt2(f, [m,n])
```
- where  $f$  is the input image,  $m$  &  $n$  are the parameters.
- 4) The extracted grey scale image is converted into vector. For gray-scale images this is a 2D-matrix, for RGB-JPEGs this is a [Width x Height x 3] array. The Matlab command for converting an image into a vector by,
- ```
Imgvector = Img(:); %convert array 'Img' to vector 'Imgvector'.
```
- 5) Vector contains many circles, distance between two circles is predicted using Euclidian distance calculation.
- 6) Distance is used to classify and analyze age, weather impact and outer layer thickness of the wood by SVM classifier.

### 2.3. Wood Dataset storage

This module explains the process of capturing x- ray wood images with various positions. Initially, there are two types of wood is considered such wet and dry tree. The laser x-ray device is used to capture the images as circle form. The each wood image is have a various levels of grains.

### 2.4. Age and Weather analysis

In this module, the extracted curve lines are used to measure the weather level and age of the wood. The curve includes more nearest then the tree considered as the hotspot wood otherwise the tree consider as rainforest tree. Also, the tree age is measured by using counted curves. The each curve represents the year of tree.

### 2.5. Finding thickness and quality of wood

In this module, the extracted curve lines are used to measure the outer layer thickness of wood. In extracted image, if the depth of the crack is high, then the wood quality is considered as low. Otherwise, if the depth of the crack is low, then the wood quality is considered as high.

## CONCLUSION

The purpose of the project is to find out the quality of the wood and also to avoid timber theft. Because the value of timber depends on the species, the quality, the length, and the diameter of the log. This approach can be implemented by using SVM (Support Vector Machine) classifier model. The measurement of tree rings would allow us to understand the past climate and help us to predict drought and flood over a period of years, which would provide economic advantages for the agriculture. The science of tree ring dating known as dendrochronology, provides techniques for the precise dating of trees. In order to effectively use the information contained in the tree-rings, there is an impending need to establish a robust method to measure the tree rings.

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