Pattern Recognition for Healing Burns to Compute Evidence: Space Syntax and Machine Learning Analysis of Burns Center Karachi

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Abstract— Usually elongated hospitalization is experienced by Burn patients, and the precise forecast of the placement of patient according to the healing acceleration has significant consequence on healthcare supply administration. Substantial amount of evidence suggest that sun light is essential to burns healing and could be exceptionally beneficial for burned patients and workforce in healthcare building. Satisfactory UV sunlight is fundamental for a calculated amount of burn to heal; this delicate rather complex matrix is achieved by applying pattern classification for the first time on the space syntax map of the floor plan and Browder chart of the burned patient. On the basis of the data determined from this specific healthcare learning technique, nurse can decide the location of the patient on the floor plan, hence patient safety first is the priority in the routine tasks by staff in healthcare settings. Whereas insufficient UV light and vitamin D can retard healing process, hence this experiment focuses on machine learning design in which pattern recognition and technology supports patient safety as our primary goal. In this experiment we lowered the adverse events from 2012- 2013, and nearly missed errors and prevented medical deaths up to 50% lower, as compared to the data of 2005- 2012 before this technique was incorporated.

In this research paper, three distinctive phases of clinical situations are considered—primarily: admission, secondly: acute, and tertiary: post-treatment according to the burn pattern and healing rate—and be validated by capable AI- origin forecasting techniques to hypothesis placement prediction models for each clinical stage with varying percentage of burn i.e. superficial wound, partial thickness or full thickness deep burn. Conclusively we proved that the depth of burn is directly proportionate to the depth of patient’s placement in terms of window distance. Our findings support the hypothesis that the windowed wall is most healing wall, here fundamental suggestion is support vector machines: which is most advantageous hyper plane for linearly divisible patterns for the burns depth as well as the depth map is used.

Index Terms — pattern recognition, burns center, space syntax, UV light for healing environment, Evidence Based Design

I. INTRODUCTION

The paper computes evidence to support the hypothesis that the depth of the burn is directly proportionate to patient placement according to the depth away from sun light source. Hence a standard procedure for assessing the depth of burn i.e. Browder chart and placement of the patient accordingly has been calculated by artificial intelligent system of pattern recognition.

As a result tripartite organization is suggested for future burn center plan with W as window wall, S as side wall and B as back wall with patients that are 20%, 40% and 60% burnt. An elaborate system of pattern recognition is found in machine learning technique. This paper is an effort towards, a multi-dimensional model of Health-related quality of life (HRQoL), where a POE including a combination of quantitative analysis as well as qualitative techniques. Here POEs will involve measuring healthcare staff and patients placement, which is been evaluated; this is achieved through variety of survey methodology including questionnaire, interview of staff and patients. The conception is established on the Ulrich [38] application that: a vision of natural elements provides optimistic sentiment and handles stresses. Pattern recognition as determinants of burn pattern and day light oriented or passive solar architecture for ward has been recognized in this research, for zoning in burns ward. For verification a field survey was conducted along where the Browder chart pattern was recognized using machine learning techniques through SVM and same was applied to recognize the pattern for the hospital plan and placement of the patient according to the burns classification.

A. Background

The heated summers of Karachi jointly with the severe high-altitude sunshine aid passive solar technique of sunlight as a fundamental design determinant [1]. The uncontrolled solar gain results in high cooling loads and excessive illumination, also augments glare. The primary concern of sunlight is to avoid solar heat gain. Here at Civil hospital which is stone made and the walls behave similar to Trombe Wall therefore this building received Environment Excellence Award in 2005.

This paper aims to assess how well buildings match users' needs, and identifies ways for future improvement in hospital design, functioning and appropriateness for purpose according to the UV light.

The following chart represents the amount of sun required for the Vitamin production. Hence this chart shows light latitude with respect to the country and the location on the globe, Karachi is located at 24.5 latitude hence, it requires 1.6 hours of direct sun light radiation for the production of sufficient Vitamin E.

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Burns is one of the major problems threatening public health in developing countries, specially Pakistan (see Figure 1) and burn injuries are among utmost devastating of all the injuries and a major global health crisis. Approximately 90% of burns occur in low to middle income countries like Pakistan, which lacks the necessary infrastructure to reduce the incidence and severity of burns.

Fig. 1. The horizontal scale shows Karachi 24°53’N the month, and the curve represents the amount of hours (Source: data from Global Solar UV INDEX, 2002).

B. Objective, Hypothesis, Significance of The Study

Here Post Occupancy Evaluation engrosses logical assessment of judgment about adoptive reused burns hospital buildings in operative condition, from the point of view of the inhabitants who are benefitting from it. This is South Asia’s biggest burn center, probably one of the largest in the world, where none of the patients is returned, it offers free of cost facility, with food, water and totally free medicines, and it has a capacity of 60 beds.

Fig. 2. Adoptive reuse studies showing the locations of patients while the photo is right shows the building before conservation (Source: Dabir-ur-Rehman).

The paper is systematically ordered as follows. “Resources and Methods” present diverse categorizations of algorithms used beside the facts of the data set. In “Measures for Burn Depth Evaluation”, we argue assessment methods and routine procedures used for evaluating diverse organizational algorithms. In “Results” section we contributed the survey of the investigational result attained using bona fide medical data from Civil Hospital Burns Center, Karachi. “Conclusion” précis our outcome and offers selected initiative for Burns Ward Design and pave possibilities for potential research.

II. MATERIALS AND METHODS

A four month quasi research was performed, on site of burns Center by principal investigator after evaluation. The Browder chart was studied for the patients at burns center and patient were placed and relocated according to the burn pattern and healing acceleration process was calculated according to burns center plan pattern recognition. The research paper was officially permitted by the Civil Hospital Karachi and hospital’s Municipal Associations Board for Therapeutic and Healthcare Study Ethics and the privacy ombudsman for the study at the Civil hospital Data Assistance for assisting the statistical compilation.

A. Projected Approach

In order to utilize data mining system for forecasting healing acceleration with respect of light, we propose an approach shown as follows:

1. Identify the drawback: Recognize procedures with the assistance of group of specialist including personnel having expertise of how to assemble the information, individuals who are burns expert for example health practitioners, nurses and staff at burns hospital Karachi. Their inclusion would ensure the rechecking of the data extracted from this experiment on site by author.

2. Data post inspection processing: is applied to improve the attributes of the statistical information and mining results.

3. Selection of classification technique: choose hyper line as one of the categorization system that can be functional on the composed data.

4. Building the classifier pattern on space syntax software and Browder- chart according to the UV light chart.

5. Assess the execution of the pattern, based on distinct events of space syntax and Browder chart then comparing with the UV light required.

6. If the results acquired are acceptable taking into consideration the categorization methods, then repeating the steps stage 3 till 6 to decide on the optimum of the case study based on the burn patient and position on the space syntax map.

7. Selecting optimum model established on performance measures and extracting the required data.

8. Apply the selected model thoroughly to achieve and evaluate results. Proposing the solution for future upcoming research.

9. Limitation, this is a Health-related quality of life (HRQoL) pattern recognition research model which is, multi-disciplinary approach, including the architectural plan design at macro level on one hand and the wound categorization at micro level of body surface area (BSA) on the other hand.

The patterns in data can be established by applying machine learning, numerical analysis, and data mining systems. The procedures to predict unknown information enclosed in data group have been challenged by investigators in diversified fields for quite some time. Owing to an array of systems, data mining distinguishes huge amount of information in volume of data. Data mining excavates information in a specific manner which can be applied in disciplines like prediction, evaluation support, estimation, and anticipation. Data mining receives benefits for progress in the field of (AI) i.e. artificial intelligence and statistics. These domains are useful in classification of pattern recognition. Supervised learning consists of methods such as Support vector machines, these are usually applied for regression and classification justification.

III. LITERATURE REVIEW

This section constitutes of literature associated to burn patient care, space syntax, UV light and pattern recognition techniques. Primarily we provided a précis of factors that may influence the healing process of burns patient according to the pattern and death proportion of burns patients, secondly a review of previous research paper on pattern recognition for burn patients.

A. UV Light And Burns

Among the many studies that have targeted SVM for prediction of accuracy amongst different clinical stages of burns patient recovery, search, most have dealt with so-called data mining retrieval by means of prediction and classifying decision information. For example, in image classification of burn wounds or using support vector machines retrieval tasks, a major issue has been constructing linearly separable, hyperplane [2]. Similarly, in study area of artificial intelligence (AI) and data mining, most works have been based on high level information such as machine learning, mixture of data, databases, pattern recognition, and content classification (e.g., indexes for the patterns are supposed to be original, potentially functional, comprehensible and suitable). However the prediction does not present much reliable association that can be applicable to patient's age and authentic factors of mortality reorganization, [3].

In this large, prospective investigation of burns pattern and space syntax pattern in relation to depth map, we found elevated risks for UV harming burns and sun radiation causing negative effects. Light, but soft light exposure, was also associated with increased risk of irritation of the sensitive skin portions [4]. We observed border line known as hyper line statistically significantly elevated risks for advanced elongation in healing process prostate with both high UV exposure, and on the other hand for superficial burn lack of appropriate UV light for healing, as described by [5].

In contrast, this study concerns a similarity-based search, which is the search of and retrieval from 2-D labeled visuals archives based solely on burn percentage of similarity in wound pattern measure. As discussed by Begoña, Serrano, Roa [6]. Though the 3- D range of applications for similarity-based search may seem narrow compared to content-based on macro level information, this is actually not the case: applications, such as detection and statistical analysis of burn depth categorization and segmentation of burn images in color [7] or Suvarna, [8] classification methods of skin burn images or segmented automation and identification of degree in the colored images of burn management on the SVM computation [9], are possible. Just as high-quality zoomed image algorithms have come into extensive use, rapid algorithms design for entire body burn pattern may too become basic technologies of handling multi-dimensional healthcare information.

Previous studies on burn patient care and administration draw immense awareness on the features that influence the healing evidences and mortality (death rate) of burn patients. An evaluation of these pertinent studies suggests four sort of feature: patient demographics, obtainable conditions of data collection on Browder chart, burn injury characteristics, and treatment factors according to positioning.

B. Burn Injury and Pattern Recognition

Burn wound character signifies main group of causes affecting the evidence of healing and mortality (rate of death) for burn patients and typically develop into the mainly significant reason governing burn patient care. Universally examined burn wound distinctiveness comprises of the extent of the burn (usually calculated by total body surface area [TBSA]) this is done on Browder chart [10] and [11]. Even though it is not easy to evaluate during early stage, the deepness, position, and amount of burns are grave aspects in supervision, healing, and effects. Basically expert services are mandatory for full-thickness burns which is beyond 5% of (BSA) i.e. body surface area partial thickness greater than 10% breathing burns or burns which is located near face, to the airway, hands, feet, and perineum.

The profundity of a burn is usually judged clinically; as described by Fenlon, [12] children burns may appear differently than an adult wound. The accurate intensity is not instantaneously apparent and burns are infrequently homogenous right through. They could be:

- Superficial: restricted to the epidermis, burn rarely requiring hospitalization, though this could be part of the pattern treatment, usually healing within 5 days. Direct sunlight would help heal.
- Partial thickness: this is considerable amount of burns, calculated in burn percentage size approximation. Sufficiently active dermal elements remain to permit healing by re-epithelialization within 10 days; hence these patients can be considered 40% burn.
- Full thickness: As shows in Fig. 6 case three; the dermis is damaged, leaving a well- segregated burn, the pattern software recognizes it as 60% burn, which might originally appear dark red, later dull yellow.

To assist estimation of the boundary of burns, separate pediatric diagram are used which take description of the varying proportions of Body Surface Area (BSA), compared with adults Figure 3. As Kim [13] refers to his recent research on allergic diseases as a major symptom of Sick Building Syndrome which has significantly increased due to pollution, he did this research.
Fig. 3. The document, used to collect data on site, (Source: Dabir-ur-Rehman) within Asian context of Korea, referring to healthy housing environment, though UV light can be beneficial to reduces air born infection.

C. SVM Hyper Plane

Pattern recognition are considered. As utmost fringe classifiers used here to create margin between wound types SVM build a separate hyper plane sandwiched between the classes. In the n-dimensional space of the inputs. This hyper plane maximizes. The margin amongst two data. Sets of two input classes. This is amongst the utmost beneficial features of SVMs in comparison with ANNs. The fringe is described as the distance between the two parallel hyper planes, on both side of the separating one, pressed against both side of the two datasets. Basically, as the margin is larger, the improved the generalization. Error for the classifier could be realized. On the other hand as far as regressions are concerned, the difference is that the SVM tries to fit in a curve, in the context of kernel applied on SVM. The technical note and the formulations are explained in further details in Figure 4 and 5. SVM generalization performance (Estimation accuracy) depends on a high-quality surroundings of meta-parameters, parameters. C, e and the kernel parameters. The difficulty of most favorable parameter selection is additionally complex due to the reason that at SVM model complexity and thus its generalization performanc. Depends on all three determinants [14]. An algorithm to resolve the difficulty of regression with SVM is proposed by Platt [15] known as sequential minimal optimization (SMO). The algorithm is easy to implement because it has a simple surroundings. There is a analytical solution to optimize the sub-problem, without the required implementation of quadratic optimizer. Shevade et al. [16] proposes an improved version, which optimises the algorithm to perform significantly quicker.

IV. CASE STUDY

We have carried out extensive experimentation to enumerate the operation of our multidimensional pattern recognition systems on Browder chart Figure 4, testing the effectiveness on the prototype of various patients burns pattern (Figure 5) and simulation of UV light via depth map analysis.

Fig. 4. Transform the input to a suitable high dimensional space then choose the separation that has maximal margins

Fig. 5. The principle of Structural. Risk. Minimization (SRM)

Here the decision surface is constructed where the void between the adjoining samples and their boundary (the. margin) is maximized.
Less arbitrariness and better generalization wide margins restrict the possible weights to choose from, and less risk to choose unsuitable weights by accident, thus this reduces the risk for bad generalization: Minimization of the structural risk = maximization of the margin. Moreover out of all hyperplanes which solve the problem the one with widest margin will generalize best.

\[
g(x) = w^T(x-x_0) = w^Tx + b = 0 \quad (1)
\]

Sides of the hyperplane

\[
w^Ty + b > 0 \text{ and } wz + b < 0 \quad (2)
\]

Projection on the hyperplane

\[
p = p_1 + p_2 \text{ where } p_1 = r \frac{w}{||w||} \quad (3)
\]

Advantages

- Very good generalization
- Works well although there are few training samples
- Fast classification

Disadvantages

- Non-local weight calculation
- Hard to implement efficiently

Points in 2D

\[
x = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \quad (4)
\]

Various techniques such as pragmatic, numerical and approaches towards soft computing are planned for considerable UV light and depth of burn prediction through length of stay [17] and [11]. Frequently geometric models are established on a sort of the action stability equation (1) and (2). While, the intricacy for executing, large amount of processing time which is needed, though when the high quantity of relevant information is not accessible and the computational database are incomplete, data mining and machine learning methodology would be appropriate alternative. This paper presents a technique to understand the relationship, of sun, and depth of wound and depth of plan through the window established on Support Vector Machines. For this rationale, Support Vector Regression (SVR) algorithm was engaged for evaluating and building a prototypical model. Prior to applying this algorithm we adopted the vector model. This model help us to classify the wound type depending on the percentage of burn on Browder chart likewise 20% ~ 30% The core idea of SVM have been furnished by Vapnik [18] and are gaining recognition due to many appealing features, and the empirical performance shows potential illustration. SVM was developed to resolve the classification obstruction, nevertheless recently SVM have been extensively used to the new sphere of regression problems. Vapnik [18]. Slight confusing is observed in the literature for the nomenclature of SVM. The phrase SVM is predominantly applied to portray classification with support vector methodology and on the other hand support vector regression is applied to illustrate regression with support vector methods. Because support vector machines have multiple applications on different domains of burn classification Patil [19] used SVM for solving the problem related with burns patient prediction of length of stay with improved estimation of distribution.

Plenty approaches for data mining, as presented, have been used for prediction. SVM was used for UV light calculation with respect of burn depth and the placement of the patient away from sun on a depth map plan as discussed earlier. Conversely, this technique (SVM) has not yet been applied on space syntax for prediction intention. SVM demonstrated satisfactory consequences in this distinct domain, SVM outperformed rest of the data mining mechanism, together with the precision criteria and the computational intricacy measures; this modeling approach would perform efficiently to predict the depth of wound and depth of burns center map. Moreover, the function approximation ability of regressive SVM and utilizing SVM we can obtain the position for the patient according to the healing acceleration in terms of sun light. This is the motivation for applying regressive SVM for this article.

A similar although further complex approach is proposed by Steadman [20] for identifying progressive shadows in the diagram of plan with possibility imposed by day-lighting and possible patterns of access. Nevertheless, the scheme is based on an intricate geometry model limited to the recognition of shadows being casted and space syntax. In addition, in this research all of the above indicated techniques of classification are established on color edge detection, which is, usually reliant on the suitable setting of pattern recognition principles to decide the space syntax depth.

Hardly any approaches have been proposed to attempt both space syntax and pattern recognition problems concurrently. Consequently, we recommended in this article a new recognition system, tailored to space syntax supported algorithms (4) that will deal simultaneously with depth of wound and placement.

The Browder Chart Figure 4 according to Marvin [21] and Treleaven [22] is considered the most precise of all the methods as it allocates an identifiable figure to each body division. This technique is generally applied to calculate burns in juvenile
children and infants for the reason that it permits for developmental transformation in proportion of body surface area.

A. Case 1: Electrical Burns

The extent of the injury is based on following aspects primarily current (voltage) i.e. the higher the voltage the more damage, the case study Mehek lost a limb Figure 4.3. Secondly Type of current i.e. Alternating Current (AC) vs. Direct Current (DC). Since AC is more dangerous than DC because it produces more heat and is associated with cardiopulmonary arrest, V-fib, tetanic muscle contractions, as presented by Rahm [23] and long bone or vertebral compression fractures. Also there is a high risk for acute renal failure, Jackson [24]. The other aspects are resistance of the body tissues; here bone has less resistance if there is more heat. Other damages could be cataract formation if contact point is head or neck. Extent of injury can be measured by external-skin burned and internal-damage to nerves and organs.

For the burns pattern, Grey [25] the general activities of the implementation from the prototype. Browder chart is similar to that from the simulation. 1 in Figure 7 and 8 representing comparison of results. The only variation is age and slight increase in the wound pattern in arm ratios by a few percent as data collection by nurse visual perception in the case shown in Figure 7 experiment. Response and hospitalization periods are not as steady as healing ratio Monstrey [26],[27] and wound visual perception, due to their serious dependency on the presented medication (which is out of the scope of this paper). Information collection network during the periods 2012-2013 when the prototype experiment is running the death rate among children significantly reduced from 5-6 to 4 per year. On the other hand, a wide-ranging healing performance can be drawn about their relative healing observation as stated by Watts, [28].

<table>
<thead>
<tr>
<th>AREA</th>
<th>BIRTH</th>
<th>AGE 1 YR</th>
<th>AGE 5 YR</th>
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<td>A = 1/2 of head</td>
<td>2 1/2</td>
<td>3 1/4</td>
<td>4</td>
</tr>
<tr>
<td>B = 1/2 of one thigh</td>
<td>2 1/2</td>
<td>2 1/2</td>
<td>2 3/4</td>
</tr>
<tr>
<td>C = 1/2 of one leg</td>
<td>2 1/2</td>
<td>2 1/2</td>
<td>2 3/4</td>
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</table>

<table>
<thead>
<tr>
<th>AREA</th>
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<th>AGE 5 YR</th>
<th>ADULT</th>
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<tbody>
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<td>4 1/2</td>
<td>3 1/2</td>
</tr>
<tr>
<td>B = 1/2 of one thigh</td>
<td>4 1/2</td>
<td>4 1/2</td>
<td>4 3/4</td>
</tr>
<tr>
<td>C = 1/2 of one leg</td>
<td>3</td>
<td>3 1/4</td>
<td>3 1/2</td>
</tr>
</tbody>
</table>

Girl name: Mehak baby
Arm detached
Age: 13 years
Touched 1100 volt wire

Fig. 7. Micro analysis of burn pattern on body surface

Fig. 8. Wound assessment Case: 2 Electric burn 4th degree loss of limb.

Several examples are provided to demonstrate pattern recognition application of the main results shown in Table presented in Figure 8. Where primarily Partial-thickness 1st Degree patient is examined under SVM techniques, where hyperline segregates the following categorization, for 1st example pediatric burn 20% as epidermis remains intact and
The second part of this research is at macro level that is planning level and it considers Civil Hospital burns center plan where most of the room spaces are naturally lit as well as naturally air circulated and ventilated. It also has views providing windows. Practically the typical floor area covers most ward beds and other ICU accommodation private rooms and the wards in burns hospitals. It would apply to the most shallow-plan operation theaters, which is artificially-lit for safety. The rationale of this portion of paper is to survey and discover the association among measures of the space diagram configuration of the floor plan for multi-bed ward, and

V. SPACE SYNTAX ANALYSIS

The yellow burns: Heal on their own within 3-7 days i.e. sunburn. Whereas orange shows superficial partial-thickness heals in less than 21 days. Here red color represents deep partial-thickness entails more than 21 days healing may require skin grafting. The rule of nines presented by [29] is a graphical and anatomical implement that divides the total body surface area. (TBSA) into subdivision that are multiples of nine percentage. The percentages applied for all body component area. (TBSA) into subdivision that are multiples of nine

proportions of body surface area (BSA) as compared with adults, as elaborated by Herndon, [30] while categorizing numerous determinants of mortality for the pediatric patients which is larger than 70% full-thickness total body surface area thermal wound may be treated by premature complete excision and grafting: Grafting is required because skin will not heal on its own (thus should be away from sun). Here Full-thickness 3rd Degree damage through the entire epidermis and dermis is shown by color in variable (mottled, black, brown, white, or red) shown in Figure 8.

Whereas Figure 7 represents surface which is dry due to Thrombosed blood vessels may be visible similar studies were carried out by Kaiser [31] as noninvasive evaluation of burn injury acuteness can be judged by the use of optical technology this is an assessment of existing and forthcoming modalities. Where Full-thickness 4th degree wounds are analyzed which involves skin, subcutaneous tissue, muscle, and often bone removal as shown in Figure 7 where electric burn 4th degree loss of limb which requires extensive surgical debridement

Summary of fire burn during Jan 2007- April 2013, shows significant reduce in mortality during experiment periods. Thus the hypothesis of depth of wound and depth of the building is proved with the use of SVM. Although in case of severe wound for adult this experiment was not very successful as shown in Figure 7 where electric burn 4th degree

loss of limb which requires extensive surgical debridement.

Table I and II where morality rate was drastically higher.

The second example shows Superficial and painful with a red appearance in hyperplane diagram and 4th case study of Shaheena 40% burn shows Partial-thickness 2nd Degree Involve the Dermis: Wet, shiny, weeping surface and Blisters. Extremely painful: though the healing dependent on burn depth and presence/absence of infection. Burns to underlying formations: beneath the dermis, burns can damage bone, and muscle; as shown in case of male patient three in Figure 10 shows 100% burn though oil and gas.

TABLE I
SUMMARY OF TREATED CHILDREN DURING JULY 2008- APRIL 2013

<table>
<thead>
<tr>
<th>Years</th>
<th>Admission</th>
<th>Discharge</th>
<th>Male</th>
<th>female</th>
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<td>427</td>
<td>261</td>
<td>222</td>
<td>32</td>
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TABLE II
SUMMARY OF FIRE BURN DURING JAN 2007- APRIL 2013

<table>
<thead>
<tr>
<th>Years</th>
<th>Admission</th>
<th>Male</th>
<th>Discharge</th>
<th>female</th>
<th>Expires</th>
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<td>2708</td>
<td>2184</td>
<td>1711</td>
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</table>

Whereas Figure 7 represents surface which is dry due to Thrombosed blood vessels may be visible similar studies were carried out by Kaiser [31] as noninvasive evaluation of burn injury acuteness can be judged by the use of optical technology this is an assessment of existing and forthcoming modalities. Where Full-thickness 4th degree wounds are analyzed which involves skin, subcutaneous tissue, muscle, and often bone removal as shown in Figure 7 where electric burn 4th degree loss of limb which requires extensive surgical debridement.

The second example shows Superficial and painful with a red appearance in hyperplane diagram and 4th case study of Shaheena 40% burn shows Partial-thickness 2nd Degree Involve the Dermis: Wet, shiny, weeping surface and Blisters. Extremely painful: though the healing dependent on burn depth and presence/absence of infection. Burns to underlying formations: beneath the dermis, burns can damage bone, and muscle; as shown in case of male patient three in Figure 10 shows 100% burn though oil and gas.

Fig. 9. Represent the Summary of fire burn during Jan 2007- April 2013 (Five patient under treatment)
subjective judgments on spatial placement for healing though UV light and space syntax Haq [32].

Fig. 10. Evening view March 2013

Fig. 11. The window wall

In the literature related to space syntax: spatial attributes for planning consider many measures of space and its interconnectedness. Specific spatial properties (e.g. integration) have been represented as connected to people’s occupying it and movement of sun in. space, functional and efficient utilization of space, and other aspects of activities. Such as space syntax has been brought into play to examine the position of sun movement and the spaces that are vulnerable to harm patient due to excessive sun Alalouch, [33].

The diagram study Figure 10 and 11, aims to investigate the relationships between staff preferences for window in multi-bed wards, and the analogous spatial attributes are computed by space syntax. Particularly, it scrutinizes the relationship between staff choice of bed location as recognized on two-dimensional depth plans and the spatial attributes of the selected position as intended by UV light visibility graph analysis.

While the second row of space divided by hyper line in Table shown in Figure , needs three steps to connect to the raw of windows of other corridors, thus here 40% burns can be hospitalized, while ward space in only needs five depths (Figure 12). Corridor # 1 therefore has a ‘deep’ relationship to all corridors and windows, while corridor # 2 has a comparatively ‘shallow’ relationship with sun light. This is expressed by a numerical concept, ‘integration’ in Figure 13. Syntax has a mathematical equation to determine this value. It considers both the number of window raw one which is connected to, as well as the step-depth of all these connections.

A windowed corridor with high integration is, on a normally, strongly connected to all spaces. Conversely, a space that is remote from all the windows, on average, is called ‘segregated space’ in terms of sun rays. Space Syntax software fabricate a figure with values of each unit space Fig 5.5, and a color-coded diagram corresponding the plan drawing indicating the distribution of those values (see Figure 5.4) in reality the photo shows this phenomena of ward, with and without the beds, both for evening and afternoon.

Fig. 12. Plan of burn Center

Figure 12 shows that corridor #1 is connected with the direct sun, hence is desirable for healing superficial burns. In this building there is an effective perimeter on the depth of the plan, here daylight can make a way into the interior, through fenestrations.
VI. DISCUSSION

Fire has been an important aspect of research, e.g. fire Security System for Hospital Khan [34]. The goal here was to recognize the procedure by which sun illumination impacts performance and human health, moreover there is a review of related literature linking hours of daylight with health products in Pakistan’s healthcare locale. For this reason in Figure two. The 3D Form arrangement is originally shaped in AutoCAD from dimensions of the building.

The reason of simulation is an evidence of hypothesis, allowing us to experiment the performance of the mechanisms under various circumstances easily. This prototype offers an examination under a true situation. Due to page constraint, we offer only an illustrative subset of experiments in this segment.

Most of the burns were accidently sustained whereas intentional burns constituted only a small percentage. Fire burns was the predominant mode of injury. The mortality was 31.2%.

The main contribution consists of primarily burn healing and architectural plan of the ward design. Though the paper start very generally, discussing the maps of Pakistan and UV Index, this could be helpful to the international audience. Initially the main contribution tends to incline towards conservational point of view, but later author molds the focus towards building design by space syntax software using Evidence Base Design technique along with Healing Environment and sustainability. Secondly analysis of the burn patient according to anatomy which is discussed in chapter 7, 8 and 16. Thirdly by use of SVM understanding and the pattern of burn and pattern of plan and the relationship between the two factors is argued.

There is a supposedly large vacuum worldwide in this field of burn healing and architectural planning, such designed combination of tool has not yet been devised yet. This paper consists of detailed introduction and literature review which was a necessity of this project. Moreover due to the vast scope of paper, it was essential to have discussion, synthesis, results, recommendation, future work, and limitation sections along with a separate conclusion sections.

VII. SYNTHESIS

The main strength of this paper is repeatability, thus this methodology has potential to be applied either in complete form or partially, to formalize several other paper. Because the use of Hyperplane as an analytical tool, for hospital at macro level and human burn pattern at micro level analyses has multiple applicability. The healing acceleration and EBD design is main strength of this paper in the case study section.

In Figure 16 the hyperplane margin divided uniformly into a double row of single aspect room’s diagram. Here we can make a distinction of three types of wall, by their arrangement. There are window walls (W) {column 1 row 3 Figure 16} coincident with the two borders of the hyperplane margin; back walls (B) {column 2 row 3 Figure 16} opposed to that of window walls; and side walls (S) {column 3 row 3 Figure 16} combination the back walls to the window walls. It is probable to place these patients according to these three types.

Here Wolfram Mathemetica version 9 is used to calculate pattern recognition as shows in the following table in figure where several examples are given to demonstrate applications of the main results. Using the regulator equations (2) and (3) to design state and error feedback regulator problems. For each of these examples the equations (1) reduce to a system of linear hyperplane.

An elaborate system of pattern recognition is found in machine learning technique. There is now much evidence to support the hypothesis that the depth of the burn is directly proportionate to patient placement according to the depth away from sun light source.

We are at present expanding our research along numerous dimensions. We are exploring other revenues of pattern recognition with the formula 1, 2 and 3 and weighing against their usefulness with staff placement scheme. We are studying the efficiency of prioritizing patients for classification at evidence stage rather than treating a patient monotonously without visual assessment.
<table>
<thead>
<tr>
<th>Patient % of burn</th>
<th>Image recognition at Micro level: hyperplane</th>
<th>Image Recognition at Macro level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric patient 21% burn</td>
<td>6 months: Tea burn</td>
<td><img src="image1" alt="Image" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient % of burn</th>
<th>Image recognition at Micro level: hyperplane</th>
<th>Image Recognition at Macro level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric patient 40%</td>
<td>2 years: Computer Browder chart</td>
<td><img src="image2" alt="Image" /></td>
</tr>
</tbody>
</table>

**Fig. 16.** Micro analysis of burn pattern on body surface VS. placement on the space syntax analysis (Photos taken by author on site)
TABLE III
SYNTHESIZES THE RESULTS STAGING THE 8 CASE STUDIES AND THERE ANALYSIS

<table>
<thead>
<tr>
<th>Color</th>
<th>Burn Percent</th>
<th>Pattern</th>
<th>Wound degree</th>
<th>Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Orange</td>
<td>20%</td>
<td>Superficial thickness</td>
<td>1st degree</td>
<td>W: strong sun lit</td>
</tr>
<tr>
<td>Pink Red</td>
<td>40%</td>
<td>Partial thickness</td>
<td>2nd - 3rd degree</td>
<td>S: semi lit</td>
</tr>
<tr>
<td>Blue green</td>
<td>60%</td>
<td>Full thickness</td>
<td>4th degree</td>
<td>B: poor lit</td>
</tr>
</tbody>
</table>

VIII. RESULTS

An overall number of 3972 patients were admitted in burns ward of Civil Hospital Karachi during five years (2006-2010). Out of these 2232, males (56.2%), and 1740 (43.8%) were females. According to the patient’s age group of 0-15 years children showed better healing in this experiment and on the other hand 544 (13.6%) male to female ratio was 1: 0.8, though adults show lesser improvement.

![Fig. 17. Functional zoning for future preferences](image)

Only small structural changes occurred during the rearranging the patient’s position according to the wound healing acceleration state where both the depth of the wound coordinated by three, 20%, 40% and 60% burn was calculated by Heimbach, Monstrey, & Figure 5. The transition structure of the space syntax plan leading to evidence depicted as the healing accelerates. The burns patients wound type changes going from the deep to superficial transition are shifted to more lit area from dark zone. The computed activation shows significant drop in number of deaths of this healing process was followed from 2013 June to 2013 June (Table. IV). Hence a standard procedure for assessing the depth of burn i.e. Browder chart and placement of the patient accordingly has been calculated by artificial intelligent system of pattern recognition. As a result tripartite organization is suggested for future burns center plan.

IX. FUTURE WORK

We are considering the effect of multiple pattern system on the routine of the burn healing mechanism. In addition to this we are also investigating the architectural serviceable situation. Future work projects by this research lab when burn pattern are placement dynamic, i.e., a patient can progress within the healing environment. This extra complicates our proposed healing mechanism as the updated re-location of all patients’ which needs to be imitate in the healing model in every case.

TABLE IV
SUMMARY OF ELECTRIC BURNS DURING 2007 TO 2013

<table>
<thead>
<tr>
<th>Years</th>
<th>Admission</th>
<th>Male</th>
<th>Expires</th>
<th>female</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>47</td>
<td>47</td>
<td>9</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>2008</td>
<td>44</td>
<td>41</td>
<td>2</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>2009</td>
<td>52</td>
<td>48</td>
<td>9</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2010</td>
<td>82</td>
<td>68</td>
<td>14</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>2011</td>
<td>74</td>
<td>69</td>
<td>8</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>2012</td>
<td>70</td>
<td>68</td>
<td>12</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>2013</td>
<td>66</td>
<td>60</td>
<td>9</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>441</td>
<td>406</td>
<td>64</td>
<td>34</td>
<td>128</td>
</tr>
</tbody>
</table>

In future work the authors plan to carry out a pattern recognition as an extension of this work to the case of pediatric ward of Korea.

X. LIMITATION

Due to the research structure, age was out of the scope of this research, here adult male showed less prone toward the experiment and showed 7% healing acceleration whereas children showed 44% which is significantly higher value in terms of betterment in burn state. The two template of Browder chart and depth map analysis was chosen due to the availability of experimental structures.

XI. CONCLUSION

The outcome of this research divulges an affiliation between the plan pattern of multi-bed burns wards and desired objective of ward design (i.e. burn depth of patients). The main response of this examination is précis in Figure 6. All measures to differentiate between deep wound and shallow plan and superficial wound and window wall buildings are listed and a scale from ‘20% wound’ via ‘predominantly strong sun light’, ‘ 40 % wound weak sun light’, ‘ 60 % wound weak sun. ’, was developed to plot the arrangement of each patient according to window wall of burns center hospitals established on the evidence brought into being. This plotting course of action was done qualitatively and this work extends the geometric theory of patient output to hyperplane distributed parameter systems.

To conclude, this article has added to a better understanding of community life in buildings by coherent understanding of an
important Space Syntax hypothesis of multifaceted buildings, which to date has not yet been acknowledged with much consideration – with the exception of a few up to date papers discussed in the section of literature review.

Conclusively we proved that the depth of burn is directly proportionate to the depth of patient’s placement in terms of window distance. Hence it could be inferred the deeper the burn the more distant the patient should be from window, and vice versa, the more superficial the burn the close the patient can be places to the window. Since deep burn can be harmed from UV, whereas superficial burns need UV to heal, therefore the pattern recognition is used to classify the burn at micro level; same technique of machine learning is applied at macro level: floor Plan.

XII. RECOMMENDATION

Usually the source of information is the formal guidelines for example Browder strom [36] architectural organizational, constructional and environmental aspect which may have an effect on member of staff safety and health and patient outcomes this schematics of bubble diagram, can be handed out among architects as practicable examples on diagrammatic depth for different side-lit building categories, a recommendation according to the depth could be added here

While assessment of the different practices for burn depth estimation the following standard are required to be considered:
1. Performance: accuracy, specificity, sensitivity and rationale.
2. Improved use: rapidity, mobility, patient wellbeing, ease of understanding, length of stay, learning curve.
3. Expenditure involved for appliance maintenance, human resources, and training.

In order to propose a better future burns plan as morphological approach of design methods. To avoid such exhaustive consideration of particular circumstances, we can consider as an alternative, the dimensions of depth of the plans of great numbers of existing buildings, where we can presume that - for the majority component - adept builders and architects have essentially accomplished adequate day-lighting at those points which are as a rule far-flung from windows.

The analysis is compared to the local case studies as well as foreign case studies; the paper follows similar technique of comparison as the following: Noninvasive assessment of burn wound severity using optical technology: a review of current and future modalities.

XIII. ACKNOWLEDGMENTS

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