International Journal of Scientific Research and Engineering Development-– Volume X Issue X, Year

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Skin Disease Detection Using Image Processing

Syed Faisal Bin Syed Wajid syed*, Tenzin Dhargyal**, Ayesha***

*(Department of Computer Science And IT Jain University, Bangalore India)

(Email: fsyed4612@gmail.com)

** (Department of Computer Science And IT Jain University, Bangalore India)

(Email: dhargyaltenzin19@gmail.com)

** (Department of Computer Science And IT Jain University, Bangalore India)

(Email: ayesha@jainuniversity.ac.in)

----------**********----------

Abstract:

Skin diseases are more common than other diseases. Skin diseases may be caused by fungal infection, bacteria, allergy, or viruses, etc. The advancement of lasers and Photonics based medical technology has made it possible to diagnose the skin diseases much more quickly and accurately. But the cost of such diagnosis is still limited and very expensive. So, image processing techniques help to build automated screening system for dermatology at an initial stage. The extraction of features plays a key role in helping to classify skin diseases. Computer vision has a role in the detection of skin diseases in a variety of techniques. Due to deserts and hot weather, skin diseases are common in Saudi Arabia. This work contributes in the research of skin disease detection. We proposed an image processing-based method to detect skin diseases. This method takes the digital image of disease effect skin area, then use image analysis to identify the type of disease. Skin diseases are among the most common medical conditions worldwide, and early detection plays a vital role in effective treatment. However, traditional diagnostic methods often depend on visual inspection and clinical experience, which can be subjective and time-consuming. Recent advancements in image processing and artificial intelligence have enabled the development of automated systems that can detect and classify various skin diseases with high accuracy. This survey paper reviews existing image processing techniques used for skin disease detection, including preprocessing, segmentation, feature extraction, and classification methods. The paper also highlights the use of deep learning architectures such as Convolutional Neural Networks (CNNs) and transfer learning models, which have significantly improved diagnostic performance. Comparative studies from previous research are analyzed to identify their strengths, limitations, and areas for improvement. The findings suggest that image-based diagnostic systems can assist dermatologists by providing faster and more objective evaluations. Future research is expected to focus on enhancing dataset diversity, real-time diagnosis, and mobile-based applications.

Keywords — Skin disease detection, image processing in dermatology, computer vision in healthcare, automated skin diagnosis, dermatological image analysis, feature extraction, image segmentation,

----------**********----------

 ©IJSRED: All Rights are Reserved

INTRODUCTION

In general, most of the common people do not know the type and stage of a skin disease. Some of the skin diseases show symptoms several months later, causing the disease to develop and grow further. This is due to the lack of medical knowledge in the public. Sometimes, a dermatologist (skin specialist doctor) may also find it difficult to diagnose the skin disease and may require expensive laboratory tests to correctly identify the type and stage of the skin disease. The advancement of lasers and photonics based medical technology has made it possible to diagnose the skin diseases much more quickly and accurately. But the cost of such diagnosis is still limited and very expensive. Therefore, we propose an image processing-based approach to diagnose the skin diseases. This method takes the digital image of disease effect skin area then use image analysis to identify the type of disease. Our proposed approach is simple, fast and does not require expensive equipment's other than a camera and a computer Skin diseases are among the most prevalent health issues worldwide, affecting millions of people each year. Early and accurate detection of these conditions is critical, as timely diagnosis can prevent disease progression, reduce complications, and improve patient outcomes. In many regions, access to specialized dermatologists is limited, making automated diagnostic tools a valuable asset for enhancing healthcare accessibility.

Traditional methods of skin disease diagnosis primarily rely on visual inspection and clinical evaluation by dermatologists. While effective in experienced hands, these methods are often subjective, time-consuming, and prone to human error. Variations in lighting, skin tone, and lesion appearance can further complicate accurate diagnosis, leading to misclassification or delayed treatment.

Recent advances in image processing and artificial intelligence offer promising solutions to these challenges. Automated systems can analyze digital images of skin lesions using techniques such as preprocessing, segmentation, feature extraction, and classification. These systems not only improve diagnostic speed but also provide more objective evaluations, reducing reliance on subjective human judgment. Deep learning models, including Convolutional Neural Networks (CNNs) and transfer learning approaches, have demonstrated significant improvements in classification accuracy, making them a key focus of current research.

The goal of this paper is to provide a comprehensive survey of existing image processing techniques for skin disease detection. By reviewing and comparing various approaches, including traditional algorithms and modern deep learning methods, this survey highlights their strengths, limitations, and potential areas for future development. Understanding these methods is essential for designing more efficient, accurate, and widely accessible diagnostic tools in dermatology.

Skin disease detection is not only important for individual health but also has a significant impact on public health systems. Conditions such as melanoma, psoriasis, eczema, and other dermatological disorders can severely affect patients' quality of life if left undiagnosed or untreated. Among these, melanoma is particularly dangerous because it can become life-threatening if not detected early.

 ©IJSRED: All Rights are Reserved

Traditional screening methods require in-person visits, specialized equipment, and expert evaluation, which can be costly and inaccessible, especially in remote or underdeveloped areas.

Moreover, manual diagnosis is influenced by several factors that can reduce accuracy. Dermatologists may face difficulties due to subtle differences between lesions, similar appearances of benign and malignant conditions, or inconsistent lighting conditions during examination. Human error, fatigue, and varying levels of expertise among practitioners further contribute to diagnostic challenges. These limitations highlight the urgent need for reliable, automated, and scalable solutions that can assist healthcare professionals while reaching underserved populations.

Image processing techniques, when applied to digital images of skin lesions, offer an effective solution to these problems. By automatically analyzing patterns, textures, shapes, and colors, such systems can identify anomalies that might be overlooked during visual inspection. Preprocessing techniques, like noise reduction and contrast enhancement, help to standardize images for more accurate analysis. Segmentation methods isolate the lesion from surrounding healthy skin, allowing precise measurement of size and shape. Feature extraction captures important characteristics such as color distribution, texture patterns, and border irregularities, which are essential for classification. Finally, machine learning and deep learning models, especially Convolutional Neural Networks (CNNs), are trained on large datasets to classify skin diseases with high accuracy, sometimes even outperforming human experts.

In addition to clinical applications, automated skin disease detection systems have the potential to be integrated into mobile applications, allowing users to perform preliminary self-screening using smartphones. This accessibility could dramatically improve early diagnosis rates, reduce unnecessary hospital visits, and ease the burden on healthcare systems. However, challenges remain, including the need for large, diverse, and high-quality datasets, as well as addressing ethical and privacy concerns related to medical imaging.

The primary objective of this survey is to review existing image processing techniques for skin disease detection, compare their effectiveness, and highlight trends in the field. By understanding current methods, researchers and developers can identify gaps, improve accuracy, and design practical tools that benefit both medical professionals and patients. This survey ultimately aims to contribute to the ongoing efforts to make dermatological diagnosis faster, more objective, and widely accessible

II.Method of Survey :

For this survey paper, relevant research on skin disease detection using image processing was collected using Google Scholar. The search was performed using keywords such as “skin disease detection,” “image processing,” and “skin lesion classification” to identify studies relevant to automated diagnostic systems. One research paper that met these criteria— **© 2019 The Author (Nawal Soliman AlKolifi AlEnezi) Journal: Procedia Computer Science** —was selected for detailed analysis. This paper was reviewed for its methodology, dataset, and findings to understand the approaches used for skin disease detection and to highlight key trends in the field.

 ©IJSRED: All Rights are Reserved

Paper (Author, Year)	Objective / Purpose	Techniques / Methods	Dataset / Images	Results / Accuracy	Strengths	Limitations	Key Takeaways
Nawal Soliman AlKolifi AlEnezi (2019)	Detect skin diseases automatically using image processing and machine learning	Image processing + Machine Learning (CNN)	2000 dermoscopic images (public dataset)	92% accuracy	Automates diagnosis, reduces human error, fast	Less accurate on darker skin tones, dataset limited	CNN-based image processing is effective; dataset diversity is needed
Manjunatha Badiger, Varuna Kumara, Sachin C N Shetty & Sudhir Poojary (2022)	To detect both leaf and skin diseases early and accurately using image processing techniques, aiming to assist in human and agricultural health	Uses K-Means clustering for segmentation and a Support Vector Machine (SVM) classifier implemented in MATLAB to categorize the diseased regions.	The exact dataset size isn't clearly given in the abstract I found. It mentions image processing of skin and leaf images but does *not* specify the number or public dataset name in the sources I accessed	"Not specified / N.S."	It addresses both skin disease *and* leaf disease in one framework using image processing, showing a broader application.	Lack of detailed dataset specification, potential generalization issues (especially for "skin" category) because typical skin-disease datasets vary widely and their mention was limited.	Image processing using K-Means + SVM is feasible for leaf/skin disease detection; but for your survey it highlights that non-deep learning (classical) methods are still being used and dataset

International Journal of Scientific Research and Engineering Development-– Volume X Issue X, Year
Available at www.ijsred.com

							transparency is a recurring issue.
R.K.M.S Karunayake (2020)	To classify skin changes (such as acne density, skin sensitivity) and other conditions (blisters, melanoma, vitiligo, etc) from images using CNN	The authors employed a transfer-learning CNN model with versions containing 50 and 101 layers, specifically using **ResNeXt** and **SE-ResNeXt** architectures.	The dataset was split into training and testing with ratio **80:20** for the "acne density and skin sensitivity" identification task.	"Not specified / N.S."	Uses a CNN-based approach, which typically results in higher accuracy and better feature extraction compared to traditional image processing methods.	If dataset size or variety is small, the model may overfit or perform poorly on unseen data.	CNN and image-processing techniques are viable for skin disease detection and constitute a promising direction for automated diagnosis.
Damilola A. Okubo yejo,	To design a prototype system that automates diagnosis of pigmented skin lesions using image classification — reducing dependence on dermatologists.	Feature extraction (texture & fractal analysis), thresholding, neural networks (ANN) for classification	Used pigmented skin-lesion images; system built as prototype (exact size not clearly specified)	The paper reports that the application "works properly" according to objectives and functionality but does **not provide a clear accuracy percentag**	Demonstrates feasibility of automated image-based skin-disease diagnosis; uses texture/fractal features and prototype implement	Limited dataset transparency and size; no clear accuracy metric; may lack robustness across diverse skin types or conditions.	Early work showing that image classification for skin diseases is viable; highlights need

 ©IJSRED: All Rights are Reserved

				e in the available summary.	ation.		for larger, well-documented datasets and clear performance metrics for future work.
Syed Inthiyaz(2023)	Automate the diagnosis and classification of skin diseases from images using deep learning.	Pre-processing (noise reduction, enhancement) → feature extraction via Convolutional Neural Network (CNN)	Utilised a skin-image dataset (details of size/types not clearly specified in the source).	The source mentions an overall accuracy of about **87%** for this model.	Shows that deep-learning (CNN) methods can deliver good performance in skin disease classification; uses automated image-based pipeline.	Dataset details (size, diversity) are not clearly specified; generalizability across skin types/conditions may be limited	Deep learning is a promising direction for automated skin-disease detection but more transparent datasets and evaluation are required for clinical adoption.
Mohammad Shorif Uddin	Automate detection and classification of various skin diseases via image segmentation	Pre-processing (hair removal, morphological filters), segmentation (GrabCut),	Used two standard datasets (ISIC 2019 Challenge and HAM10000)	SVM performed best among tested classifiers (exact	Comprehensive pipeline combining segmentation and multiple	Accuracy metric not clearly stated; may have limited generalizability due to	Machine learning with image segme

 ©IJSRED: All Rights are Reserved

	and machine learning	feature extraction	of skin lesion images.	percentage not clearly specified in summary).	ML classifiers; validated on recognized public datasets.	dataset constraints and only traditional ML methods.	ntation is effective for skin disease detection; further development needed for clearer performance metrics and use of more diverse datasets.
Prem J. Patil(2020)	Develop a mobile-based, user-friendly system to detect and classify skin disease patches via image processing	Image preprocessing, Bag of Features extraction, classification (machine learning model) using feature vectors.	Skin-lesion images captured via mobile interface; 4 sample classes mentioned, exact image count not clearly specified	Model able to classify images of 4 sample classes using cross-validation; exact % accuracy not clearly specified.	Focuses on accessibility (mobile interface), and automating diagnosis support in areas without expert dermatologists.	Dataset size and diversity not well specified; accuracy details lacking; likely needs larger dataset for generalizability.	Demonstrates feasibility of mobile-image-based skin disease detection using image processing + ML; highli

 ©IJSRED: All Rights are Reserved

							ghts need for cleare r datase t docu menta tion and perfor mance metric s.
V. Pugazhenthi(201 9)	Improve diagnostic accuracy of skin diseases by using image processing and classification techniques to detect conditions like melanoma, leprosy,	Pre-processi ng (contrast enhancemen t, grayscale conversion), segmentatio n via global thresholding ,	Input images from camera; exact image count not clearly specified	The study reports high cure potential and improved diagnostic system accuracy, but does *not* provide a clear numeric accuracy percentage	Automates disease detection; uses texture features and quality-ass essment metrics linking image-pro cessing and classificati on effectively .	Lack of precise dataset size, absence of explicit accuracy metric; may not generalize across diverse skin types or disease conditions.	Image -proce ssing plus classif icatio n is a viable appro ach for skin diseas e detect ion; future work shoul d includ e larger datase ts and cleare r perfor mance metric s.

 ©IJSRED: All Rights are Reserved

Aishwarya Bhavsar (2019)	Develop a mobile-based system to detect skin diseases (Melanoma, Impetigo, Eczema) using image processing + data mining + deep learning.	Pre-processing → Segmentation → Feature extraction → Classification. They compare Support Vector Machine (SVM) and Convolutional Neural Network (CNN).	Images of skin lesions (captured via mobile or from dataset); exact number of images not clearly specified	They present a comparison of SVM vs CNN and claim improved accuracy with CNN, but **no specific percentage** clearly stated.	Mobile-based application; uses modern deep learning (CNN) + data mining for skin disease detection.	Dataset size and detail not clearly specified; accuracy numbers not clearly provided; generalizability may be limited.	Combining image processing, data mining and deep learning is promising for automated skin-disease diagnosis; clearer dataset documentation and performance metrics needed for future work.
Kritika Sujay Rao(2021)	Develop a multiclass deep-learning model to distinguish healthy skin from skin diseases and classify several lesion types.	Convolutional Neural Network (CNN) using Keras; data pre-processing (cleaning, transformation), exploratory analysis,	Dermoscopic images classified into 7 categories including Melanocytic Nevi, Melanoma,	Improved classification performance using CNN though no specific accuracy percentage is clearly stated in the	Demonstrates use of deep learning for skin disease detection; multiclass classification model supports multiple lesion	Dataset size and details are not clearly provided; missing explicit numeric accuracy limits comparability.	Deep-learning (CNN) approaches show promise for automated skin

 ©IJSRED: All Rights are Reserved

		label encoding of 7 classes.		summary	types.		diseas e diagn osis; furthe r work neede d for datase t transp arenc y and perfor mance measu remen t

III. Methodology :

In this section, the methodology of the proposed system for detection, extraction and classification of skin diseases images is described. The system will help significantly in the detection of melanoma, Eczema and Psoriasis. The whole architecture can be divided into several modules comprising of preprocessing, feature extraction, and classification. The block diagram of the system is shown in Fig 2

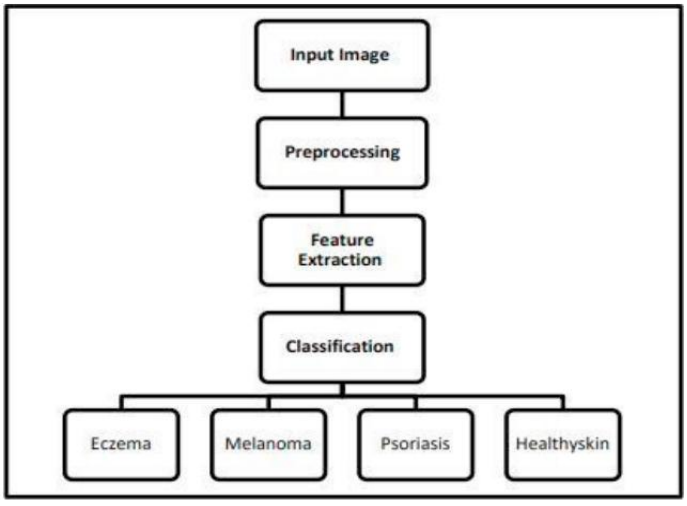

Fig. 2. The proposed system block diagram.

 ©IJSRED: All Rights are Reserved

IV. Preprocessing:

Fig. 3. Example of Original image of Eczema database.

Fig. 4. Example of resizing image of Eczema database.

 ©IJSRED: All Rights are Reserved

V. Feature Extraction:

At the beginning, Convolutional Neural Network (CNN) is a set of stacked layers involving both nonlinear and linear processes. These layers are learned in a joint manner. The main building blocks of any CNN model are: convolutional layer, pooling layer, nonlinear Rectified Linear Units (ReLU) layer connected to a regular multilayer neural network called fully connected layer, and a loss layer at the backend. CNN has known for its significant performance in applications as the visual tasks and natural language processing [8].

VI. Classification :

Classification is a computer vision method. After extracting features, the role of classification is to classy the image via Support Vector Machine (SVM). A SVM can train classifier using extracted features from the training set

VII. Result :

The system is implemented in MATLAB 2018b. We used a platform of Intel Core i3 processor 2.10 GHz with 4- GB RAM. The Implementation results are shown in Figure 6. Initially, the input images are preprocessed, then features are extracted using pretrained CNN. Finally, classification is performed using SVM classifier

Fig. 6. Result Screen.

 ©IJSRED: All Rights are Reserved

In this study, 100 skin images were used by several dermatological disease patients, also were taken from the Internet. The proposed system can successfully detect 3 different skin diseases with an accuracy of 100%.

VIII. Conclusion :

Detection of skin diseases is a very important step to reduce death rates, disease transmission and the development of the skin disease. Clinical procedures to detect skin diseases are very expensive and time-consuming. Image processing techniques help to build automated screening system for dermatology at an initial stage. The extraction of features plays a key role in helping to classify skin diseases.

In this research, a method for skin disease detection was developed using a combination of a pretrained Convolutional Neural Network (AlexNet) and a Support Vector Machine (SVM) classifier. The proposed system demonstrated promising results in accurately identifying skin conditions based on image processing techniques. This approach contributes significantly to the field of computer-aided dermatology, offering a fast and reliable diagnostic tool.

Additionally, the limited access to dermatological care in rural and underserved areas highlights the need for such technology-driven solutions. The proposed system can assist healthcare professionals in early diagnosis, reduce the burden on medical infrastructure, and ultimately improve patient care across the country.

IX. Reference's :

[1] N. S. AlKolifi AlEnezi, **A Method Of Skin Disease Detection Using Image Processing And Machine Learning 2019**. Procedia Computer Science 163 (2019)
[2] Yasir, R., Rahman, A., & Ahmed, N. (2014) **"Dermatological Disease Detection using Image Processing and Artificial Neural Network.** "Dhaka: International Conference on Electrical and Computer Engineering
[3] Santy, A., & Joseph, R. (2015) "**Segmentation Methods for Computer Aided Melanoma Detection."** Global Conference on Communication Technologies.
[4] Zeljkovic, V., Druzgalski, C., Bojic-Minic, S., Tameze, C., & Mayorga, P. (2015) **" Supplemental Melanoma Diagnosis for Darker Skin Complexion Gradients."** Pan American Health Care Exchanges
[5] Suganya R. (2016) **"An Automated Computer Aided Diagnosis of Skin Lesions Detection and Classification for Dermoscopy Images."** International Conference on Recent Trends in Information Technology.
[6] Alam, N., Munia, T., Tavakolian, K., Vasefi, V., MacKinnon, N., & Fazel-Rezai, R. (2016) **"Automatic Detection and Severity Measurement of Eczema Using Image Processing." IEEE.**
[7] Kumar, V., Kumar, S., & Saboo, V. (2016) **"Dermatological Disease Detection Using Image Processing and Machine Learning." IEEE.**

[8] Krizhevsky, A., ILYA, S., & Geoffrey, E. (2012) **"ImageNet Classification with Deep Convolutional Neural Networks."** Advances in Neural Information Processing Systems.
[9] Cristianini, N., Shawe, J., **"Support Vector Machines",** 2000.

 ©IJSRED: All Rights are Reserved

[10] SOMMERVILLE, I., **"Software Engineering"**. 9th .2011
[11] **Syed Inthiyaz(2023)** Automate the diagnosis and classification of skin diseases from images using deep learning Pre-processing (noise reduction, enhancement) → feature extraction via Convolutional Neural Network (CNN)

[12] **Aishwarya Bhavsar(2019)** Develop a mobile-based system to detect skin diseases (Melanoma, Impetigo, Eczema) using image processing + data mining + deep learning

[13] **Kritika Sujay Rao(2021)** Develop a multiclass deep-learning model to distinguish healthy skin from skin diseases and classify several lesion types

[14] **Damilola A. Okuboyejo** To design a prototype system that automates diagnosis of pigmented skin lesions using image classification — reducing dependence on dermatologists

[15] **R.K.M.S Karunayake (2020)** To classify skin changes (such as acne density, skin sensitivity) and other conditions (blisters, melanoma, vitiligo, etc) from images using CNN

[16] **Mohammad Shorif** Uddin Automate detection and classification of various skin diseases via image segmentation and machine learning

[17] **Prem J. Patil(2020)** Develop a mobile-based, user-friendly system to detect and classify skin disease patches via image processing

[18] **V. Pugazhenthi(2019)** Develop a multiclass deep-learning model to distinguish healthy skin from skin diseases and classify several lesion types.

[19] **Manjunatha Badiger, Varuna Kumara,** Sachin C N Shetty & Sudhir Poojary (2022) To detect both leaf and skin diseases early and accurately using image processing techniques, aiming to assist in human and agricultural health

[20] **Yasir, R., Rahman, A., & Ahmed, N. (2014)** "Dermatological Disease Detection using Image Processing and Artificial Neural Network. "Dhaka*: International Conference on Electrical and Computer Engineerin*

 ©IJSRED: All Rights are Reserved

Title must be in 24 pt Regular font. Author name must be in 11 pt Regular font. Author affiliation must be in 10 pt Italic. Email address must be in 9 pt Courier Regular font.

TABLE I
FONT SIZES FOR PAPERS

Font Size	Appearance (in Time New Roman or Times)		
	Regular	**Bold**	**Italic**
8	table caption (in Small Caps), figure caption, reference item		reference item (partial)
9	author email address (in Courier), cell in a table	abstract body	abstract heading (also in Bold)
10	level-1 heading (in Small Caps), paragraph		level-2 heading, level-3 heading, author affiliation
11	author name		
24	title		

AGE LAYOUT

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

A. Page Layout

Your paper must use a page size corresponding to A4 which is 210mm (8.27") wide and 297mm (11.69") long. The margins must be set as follows:

- Top = 19mm (0.75")
- Bottom = 43mm (1.69")
- Left = Right = 14.32mm (0.56")

Your paper must be in two column format with a space of 4.22mm (0.17") between columns.

I. PAGE STYLE

All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

B. Text Font of Entire Document

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes.

Recommended font sizes are shown in Table 1.

C. Title and Author Details

All title and author details must be in single-column format and must be centered.

Every word in a title must be capitalized except for short minor words such as “a”, “an”, “and”, “as”, “at”, “by”, “for”, “from”, “if”, “in”, “into”, “on”, “or”, “of”, “the”, “to”, “with”.

Author details must not show any professional title (e.g. Managing Director), any academic title (e.g. Dr.) or any membership of any professional organization (e.g. Senior Member IEEE).

To avoid confusion, the family name must be written as the last part of each author name (e.g. John A.K. Smith).

Each affiliation must include, at the very least, the name of the company and the name of the country where the author is based (e.g. Causal Productions Pty Ltd, Australia).

Email address is compulsory for the corresponding author.

D. Section Headings

No more than 3 levels of headings should be used. All headings must be in 10pt font. Every word in a heading must be capitalized except for short minor words as listed in Section III-B.

 ©IJSRED: All Rights are Reserved

*1) **Level-1 Heading:*** A level-1 heading must be in Small Caps, centered and numbered using uppercase Roman numerals. For example, see heading "III. Page Style" of this document. The two level-1 headings which must not be numbered are "Acknowledgment" and "References".

*2) **Level-2 Heading:*** A level-2 heading must be in Italic, left-justified and numbered using an uppercase alphabetic letter followed by a period. For example, see heading "C. Section Headings" above.

3) ***Level-3 Heading:*** A level-3 heading must be indented, in Italic and numbered with an Arabic numeral followed by a right parenthesis. The level-3 heading must end with a colon. The body of the level-3 section immediately follows the level-3 heading in the same paragraph. For example, this paragraph begins with a level-3 heading.

E. Figures and Tables

Figures and tables must be centered in the column. Large figures and tables may span across both columns. Any table or figure that takes up more than 1 column width must be positioned either at the top or at the bottom of the page.

Graphics may be full color. All colors will be retained on the CDROM. Graphics must not use stipple fill patterns because they may not be reproduced properly. Please use only *SOLID FILL* colors which contrast well both on screen and on a black-and-white hardcopy, as shown in Fig. 1.

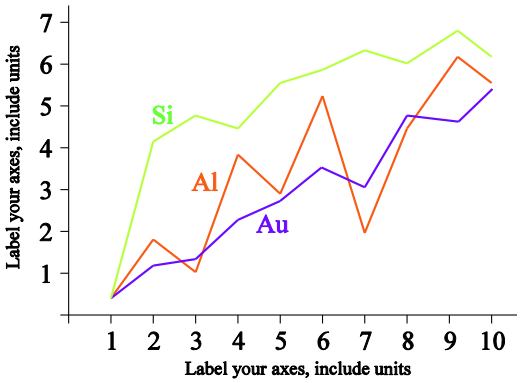

Fig. 1 A sample line graph using colors which contrast well both on screen and on a black-and-white hardcopy

Fig. 2 shows an example of a low-resolution image which would not be acceptable, whereas Fig. 3 shows an example of an image with adequate resolution. Check that the resolution is adequate to reveal the important detail in the figure.

Please check all figures in your paper both on screen and on a black-and-white hardcopy. When you check your paper on a black-and-white hardcopy, please ensure that:

- the colors used in each figure contrast well,
- the image used in each figure is clear,
- All text labels in each figure are legible.

F. Figure Captions

Figures must be numbered using Arabic numerals. Figure captions must be in 8 pt Regular font. Captions of a single line (e.g. Fig. 2) must be centered whereas multi-line captions must be justified (e.g. Fig. 1). Captions with figure numbers must be placed after their associated figures, as shown in Fig. 1.

Fig. 2 Example of an unacceptable low-resolution image

Fig. 3 Example of an image with acceptable resolution

 ©IJSRED: All Rights are Reserved

G. Table Captions

Tables must be numbered using uppercase Roman numerals. Table captions must be centred and in 8 pt Regular font with Small Caps. Every word in a table caption must be capitalized except for short minor words as listed in Section III-B. Captions with table numbers must be placed before their associated tables, as shown in Table 1.

H. Page Numbers, Headers and Footers

Page numbers, headers and footers must not be used.

I. Links and Bookmarks

All hypertext links and section bookmarks will be removed from papers during the processing of papers for publication. If you need to refer to an Internet email address or URL in your paper, you must type out the address or URL fully in Regular font. References

The heading of the References section must not be numbered. All reference items must be in 8 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]).

When referring to a reference item, please simply use the reference number, as in [2]. Do not use "Ref. [3]" or "Reference [3]" except at the beginning of a sentence, e.g. "Reference [3] shows …". Multiple references are each numbered with separate brackets (e.g. [2], [3], [4]–[6]).

Examples of reference items of different categories shown in the References section include:

- example of a book in [1]
- example of a book in a series in [2]
- example of a journal article in [3]
- example of a conference paper in [4]
- example of a patent in [5]
- example of a website in [6]
- example of a web page in [7]
- example of a databook as a manual in [8]
- example of a datasheet in [9]
- example of a master's thesis in [10]
- example of a technical report in [11]
- example of a standard in [12]

II. CONCLUSIONS

The version of this template is V2. Most of the formatting instructions in this document have been compiled by Causal Productions from the IEEE LaTeX style files. Causal Productions offers both A4 templates and US Letter templates for LaTeX and Microsoft Word. The LaTeX templates depend on the official IEEEtran.cls and IEEEtran.bst files, whereas the Microsoft Word templates are self-contained. Causal Productions has used its best efforts to ensure that the templates have the same appearance.

Causal Productions permits the distribution and revision of these templates on the condition that Causal Productions is credited in the revised template as follows: "original version of this template was provided by courtesy of Causal Productions (www.causalproductions.com)".

ACKNOWLEDGMENT

The heading of the Acknowledgment section and the References section must not be numbered.

Causal Productions wishes to acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template. To see the list of contributors, please refer to the top of file IEEETran.cls in the IEEE LaTeX distribution.

REFERENCES

[1] S. M. Metev and V. P. Veiko, *Laser Assisted Microtechnology*, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.

[2] J. Breckling, Ed., *The Analysis of Directional Time Series: Applications to Wind Speed and Direction*, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.

[3] S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," *IEEE Electron Device Lett.*, vol. 20, pp. 569–571, Nov. 1999.

[4] M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in *Proc. ECOC'00*, 2000, paper 11.3.4, p. 109.

[5] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.

[6] (2002) The IEEE website. [Online]. Available: http://www.ieee.org/

 ©IJSRED: All Rights are Reserved

[7] M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/
[8] *FLEXChip Signal Processor (MC68175/D)*, Motorola, 1996.
[9] "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
[10] A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
[11] J. Padhye, V. Firoiu, and D. Towsley, "A stochastic model of TCP Reno congestion avoidance and control," Univ. of Massachusetts, Amherst, MA, CMPSCI Tech. Rep. 99-02, 1999.
[12] *Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification*, IEEE Std. 802.11, 1997.

 ©IJSRED: All Rights are Reserved