



TARJETA INFORMATIVA

PARA	Dr. Alfonso Padilla Vivanco Secretario Académico de la UPT
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ASUNTO	Conclusión de Proyecto
FECHA	23 febrero 2022

Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

"Characterizations and Use of Recycled Optical Components for Polarizing Phase-Shifting Interferometry Applications"

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

Se anexa al presente documento la evidencia de la publicación.

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ATENTAMENTE



Article

Characterizations and Use of Recycled Optical Components for Polarizing Phase-Shifting Interferometry Applications [†]

Juan M. Islas-Islas ¹, Germán Reséndiz-López ^{1,2}, José G. Ortega-Mendoza ², Luis García-Lechuga ¹, Adolfo Quiroz ³, David-Ignacio Serrano-García ⁴, Benito Canales-Pacheco ⁵ and Noel-Ivan Toto-Arellano ^{1,*}

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[†] This paper is dedicated to the memory of our marvelous colleague, Doctor Gustavo Rodríguez Zurita. "That person who helps others simply because it should or must be done and because it is the right thing to do, is genuine without a doubt, a real superhero (SL)".

Abstract: In this research, we report using optical components such as cubic beam splitters, lenses, diffraction gratings, and mirrors from broken, obsolete, or disused electronic devices to implement a simultaneous polarization-based phase-shifting interferometric system. The system is composed of a polarized Mach-Zehnder interferometer (PMZI) which generates a sample pattern coupled to a 4f imaging system with a diffraction grating placed on its Fourier plane. Such a diffractive element replicates the pattern generated by the PMZI, and each replica is centered and modulated by each diffraction order generated by the grating. The corresponding individual phase shifts are controlled by placing linear polarizers with known angles in front of each replica. Experimental results are presented using several phase samples such as an oil drop, a pseudoscorpion claw, a microarthropod, and red blood cells. In addition, a comparison of the retrieved phase was conducted by employing two different phase demodulation algorithms.

Keywords: interferometry; phase shifting; polarization



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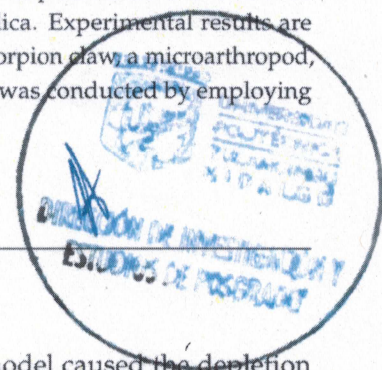
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1. Introduction

In the last few decades, the so-called brown economic model caused the depletion of natural resources, degradation, and widespread loss of ecosystems. As a response, an alternative economic model emerged called the green economy. An essential part of the green economy model is the circular economy practice of reducing, reusing, and recycling (3R scheme) [1,2]. Following this 3R scheme, we implemented a polarization-based phase-shifting interferometric system using recovered optics from electronic waste [3].

Today, throwing away CD/DVD reading devices and broken or obsolete projectors is prevalent. However, those devices are sources of good-quality optical components such as lenses, mirrors, diffraction gratings, cubic beam splitters, polarizer sheets, and Fresnel lenses, among others that can be used in the implementation of interferometric systems. Currently, several industrial sectors and academic fields incorporate optical and photonic technologies for quality inspection metrics [4–7]; therefore, it is important to develop interferometric techniques and devices capable of contactless high-precision measurements applied to phase objects [4–10].

There are a wide variety of techniques to perform these measurements, mainly based on the recovery of the optical phase. Several methods are applied in this field, with Fourier





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ASUNTO	Conclusión de Proyecto
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Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

" Improvement of Retinal Images Affected by Cataracts "

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

Se anexa al presente documento la evidencia de la publicación.

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ATENTAMENTE



Article

Improvement of Retinal Images Affected by Cataracts

Enrique Gonzalez-Amador ^{1,2}, Justo Arines ^{3,4,*}, Pablo Charlón ^{5,6}, Nery Garcia-Porta ³, Maximino J. Abrales ^{7,8} and Eva Acosta ^{2,4}

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Abstract: Eye fundus images are used in clinical diagnosis for the detection and assessment of retinal disorders. When retinal images are degraded by scattering due to opacities of the eye tissues, the precise detection of abnormalities is complicated depending on the grading of the opacity. This paper presents a concept proof study on the use of the contrast limited adaptive histogram equalization (CLAHE) technique for better visualization of eye fundus images for different levels of blurring due to different stages of cataracts. Processing is performed in three different color spaces: RGB, CIELAB and HSV, with the aim of finding which one better enhances the missed diagnostic features due to blur. The experimental results show that some fundus features not observable by naked eye can be detected in some of the space color processed with the proposed method. In this work, we also develop and provide an online image process, which allows clinicians to tune the default parameters of the algorithm for a better visualization of the characteristics of fundus images. It also allows the choice of a region of interest (ROI) within the images that provide better visualization of some features than those enhanced by the processing of the full picture.

Keywords: retinal images; eye opacities; cataracts; CLAHE; RGB; CIELAB; HSV



Citation: Gonzalez-Amador, E.; Arines, J.; Charlón, P.; Garcia-Porta, N.; Abrales, M.J.; Acosta, E. Improvement of Retinal Images Affected by Cataracts. *Photonics* **2022**, *9*, 251. <https://doi.org/10.3390/photronics9040251>

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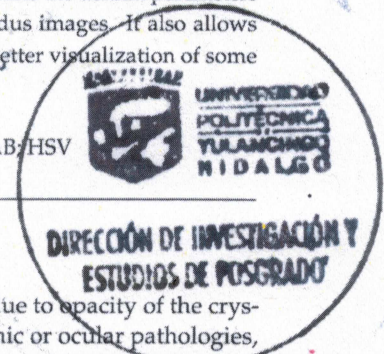


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1. Introduction

Cataract is a common eye condition which cause vision loss due to opacity of the crystalline lens. Its development is related with genetics, aging, systemic or ocular pathologies, or injuries [1]. The loss of vision is manifested by a reduction in contrast due to scattering at the tissues. This pathology not only limits vision to patients, but also can impede visualization of the eye fundus, confusing or complicating the diagnosis of ocular pathologies such as age-related macular degeneration or Stargardt disease [2], retinal detachment, diabetic retinopathy [3], or visceral leishmaniasis [4]. Systemic illness, such as diabetes, not only affects the eye fundus, inducing retinal hemorrhages and venous tortuosity, but also causes cataract development [3]. A crystalline lens might present different stages of cataracts, which cause a shift in the color temperature of retinal images to warmer temperatures and a reduction of the contrast due to intraocular scattering.

Detecting the finer details of the fundus images is very important for eye doctors to provide an accurate diagnosis. Improvement of blurred eye fundus images has been





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ASUNTO	Conclusión de Proyecto
FECHA	4 de junio 2022

Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

" Optical cavitation in non-absorbent solutions using a continuous-wave laser via optical fiber"

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

Se anexa al presente documento la evidencia de la publicación.

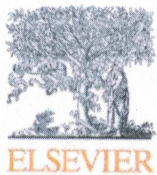
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ATENTAMENTE





Optical cavitation in non-absorbent solutions using a continuous-wave laser via optical fiber

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ARTICLE INFO

Keywords:

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Copper nitrate
Continuous-wave laser

ABSTRACT

Optical cavitation can be induced by short pulse lasers focused into a solution with a low absorption coefficient or using a continuous-wave laser focused into highly absorbent solutions. In this work, we report the generation of cavitation bubbles in ethanol using a continuous-wave fiber optic laser with emission at 450 nm wavelength. Silver and copper nitrate nanoparticles were immobilized on the flat end-face of a multimode optical fiber tip using the photodeposition-technique and then immersed into the solution. Laser light transmitted through the optical fiber is strongly absorbed by both nanoparticles causing an abrupt increase in temperature around the tip of the optical fiber, reaching the spinodal limit of ethanol (~187 °C). At this temperature, an explosive phase transition (liquid–gas) occurs causing the generation of a microbubble, which grows until reaches its maximum radius (~1072 μm in 132 μs) and subsequently collapses, emitting a shock wave. The dynamic behavior of the gas bubble was studied as a function of the laser power using a high-speed video camera, and the shock wave emitted immediately after the bubbles collapse was detected by a microphone. The pressure of the shock wave was analyzed photodepositing different thin films of silver nanoparticles at the tip of the optical fiber, causing optical attenuations of 1, 3, 5, and 7 dB. The experimental results obtained showed that when a thin film of copper nitrate nanoparticles was photodeposited on a film of silver nanoparticles (5 dB), the pressure of the shock wave increases up to ~13-fold, in comparison, if we use only one film of silver nanoparticles. Energetic shock waves have potential applications in a variety of areas such as medicine, biological sciences, material processing, liquid microjets generation, among others.

1. Introduction

The phenomenon of optical cavitation has attracted attention because bubble collapse has many interesting applications in science and engineering, such as: sonoluminescence [1], cavitation damage [2], surface cleaning [3], shock wave generation [4], among others. Optical cavitation is normally produced by short laser pulses focused inside a cuvette with a solution with low absorption coefficient, commonly water. In this case, the light intensity at the focus is so high that the nonlinear absorption or avalanche ionization leads to plasma formation, which can be rapidly heated up by the laser leading to water explosive vaporization, producing a vapor bubble [5,6]. The use of pulsed lasers is not the only method to produce optical cavitation bubbles; it can be produced by a continuous-wave (CW) laser; however, it must be focused

into a highly absorbent solution, which is generally a mixture of water with some dye [7]. Here, the photon flux is strongly absorbed by a small volume of the solution heated up until the critical limit of water (~300 °C), around this temperature the small volume of superheated water is converted to vapor producing a fast-expanding bubble, which is known as thermocavitation bubble [7].

On the other hand, in 2004 Taylor et al. reported the generation of vapor bubbles at the output end of an optical fiber, which was covered with platinum nanoparticles and immersed in water. In that work, the bubbles were formed due to heat transfer from the nanoparticles to water [8]. Eight years later, Pimentel-Rodriguez et al. reported the generation of microbubbles using fiber optic tips coated with carbon nanoparticles and metallic powders; furthermore, they provide details about the hydrodynamic effects induced around the vicinity of the fiber

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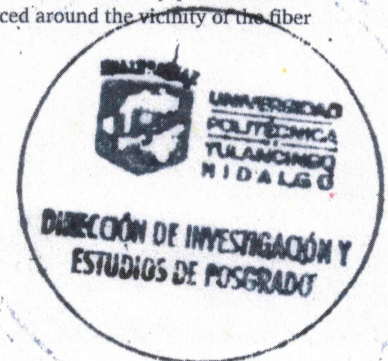
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FECHA	18 de julio 2022

Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

" Modelo Híbrido de Identidad Educativa Regional para zonas marginadas en la región Otomí Tepehua, México"

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

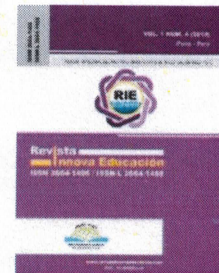
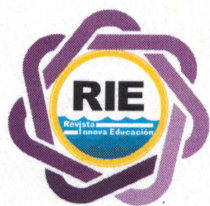
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ATENTAMENTE





Modelo Híbrido de Identidad Educativa Regional para zonas marginadas en la región Otomí Tepehua, México

Hybrid Model of Regional Educational Identity for marginalized areas in the Otomí Tepehua region, Mexico

Modelo híbrido de identidade educacional regional para áreas marginalizadas na região de Otomí Tepehua, México

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PALABRAS CLAVE

educación a distancia,
híbrido, identidad,
modelo educacional,
pobreza.

RESUMEN. El presente trabajo tuvo por objetivo integrar un Modelo Híbrido de Identidad Educativa Regional para zonas marginadas de la región Otomí Tepehua, en el oriente del estado de Hidalgo, México, cuyo propósito es reforzar la educación a distancia para áreas con un grado alto de vulnerabilidad. Fue una investigación de tipo cualitativa, descriptiva, no experimental y con corte transversal e in situ a partir de referentes teóricos mediante teoría fundamentada, la técnica de recolección de datos fue entrevistas semiestructuradas a profundidad. El resultado consistió en integrar las fuerzas endógenas y exógenas a partir de los datos obtenidos del contexto en un modelo con cada una de sus variables y los requerimientos para su implementación, se concluyó en una reflexión de los intentos que gobiernos de todos los niveles y de teóricos han presentado dado el escenario COVID-19, en la urgente necesidad de conectividad adecuada en la zona de estudio y en la necesidad de considerar al aprendizaje holístico, flexible, regional y global, e incluir conceptos que provengan de sus usos, costumbres y forma de vida integrados a una realidad internacional.

¹ Doctor en Ciencias Administrativas por el Instituto Politécnico Nacional, autor de diversas publicaciones nacionales e internacionales.





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FECHA	31 de agosto 2022

Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

**" Rotation-invariant image classification using a novel 1D CNN and Multichannel Accurate Bessel-Fourier moments
Clasificación de imágenes invariantes a la rotación utilizando una novedosa CNN en 1D y Momentos exactos de Bessel-Fourier"**

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

Se anexa al presente documento la evidencia de la publicación.

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ATENTAMENTE



Rotation-invariant image classification using a novel 1D CNN and Multichannel Accurate Bessel-Fourier moments

Clasificación de imágenes invariantes a la rotación utilizando una novedosa CNN en 1D y Momentos exactos de Bessel-Fourier

C. J. Camacho-Bello ^{a,*}, L. Gutiérrez-Lazcano ^a, R. M. Ortega-Mendoza ^a

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Resumen

Este trabajo presenta una propuesta para utilizar momentos de Bessel-Fourier como entradas a redes neuronales convolucionales 1D de tal manera que aprovechen las características inherentes de los descriptores de tipo de momento, como la invariancia rotacional y la mínima redundancia de información. Los resultados presentados muestran que la propuesta tiene un mejor desempeño que la red neuronal profunda con invariancia de rotación.

Palabras Clave: Momentos de Bessel-Fourier, características de invariante rotación, aprendizaje profundo, morfologías de galaxias.

Abstract

This work presents a proposal to use Bessel-Fourier moments as inputs to 1D convolutional neural networks in such a way that they take advantage of the inherent characteristics of moment type descriptors such as rotational invariance and minimal information redundancy. The results presented show that the proposal has a better performance than the deep neural network with rotation invariance.

Keywords: Bessel-Fourier moments, Rotation-Invariant features, Deep learning, Galaxy morphologies.

1. Introduction

Orthogonal moments are rotational invariant image descriptors with minimal information redundancy (Teague, 1980). Descriptor-based classifiers differ primarily in the characteristics that local or global. Generally, the most used methods are distance and predefined similarity measures. However, only a few studies have considered 1D convolutional neural networks to accomplish this task; this is surprising since deep learning has revolutionized different machine learning fields by developing novel neural networks.

In general, the problem related to classifying images affected by random orientations can be treated differently. One way to tackle this problem is to integrate rotated samples into the training dataset (Cheng et al., 2016). However, this does not help to demonstrate that features are rotation-invariant because the classifier does not consider each object's shape features. Another approach is based on extracting rotational invariant

descriptors such as an object's descriptors will be identical, regardless of the object's orientation.

On the other hand, several advances in endowing a deep neural network with rotation invariance by modifying the network's internal filters to obtain characteristics invariant to rotation; the approach includes Oriented Response Networks (ORN) (Zhou et al., 2017), Covariant CNN (Rodriguez et al., 2019), Rotation Invariant Convolutional (RIC) (Follmann and Bottger, 2018), and Rotation Invariant Networks (RIN) (Rodriguez Salas et al., 2021). Also, few studies train their algorithms with upright images database and validate rotated samples (Zhou et al. (2017); Follmann and Bottger (2018); Rodriguez et al. (2019); Rodriguez Salas et al. (2021)). In state-of-the-art, invariant descriptors' performance is validated using the MNIST database of handwritten digit images to train and the MNIST-R database to validate the results.

For this reason, we propose to replace the modified filters with moment type descriptors such as Bessel-Fourier moments.

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Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

"Cuscuta spp. Segmentation Based on Unmanned Aerial Vehicles (UAVs) and Orthomosaics Using a U-Net Xception-Style Model"

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

Se anexa al presente documento la evidencia de la publicación.

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ATENTAMENTE

DIRECCIÓN DE INVESTIGACIÓN Y
ESTUDIOS DE POSGRADO





Article

Cuscuta spp. Segmentation Based on Unmanned Aerial Vehicles (UAVs) and Orthomosaics Using a U-Net Xception-Style Model

Lucia Gutiérrez-Lazcano ¹, César J. Camacho-Bello ^{1,*}, Eduardo Cornejo-Velazquez ²,
José Humberto Arroyo-Núñez ¹ and Mireya Clavel-Maqueda ²

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Abstract: *Cuscuta* spp. is a weed that infests many crops, causing significant losses. Traditional assessment methods and onsite manual measurements are time consuming and labor intensive. The precise identification of *Cuscuta* spp. offers a promising solution for implementing sustainable farming systems in order to apply appropriate control tactics. This document comprehensively evaluates a *Cuscuta* spp. segmentation model based on unmanned aerial vehicle (UAV) images and the U-Net architecture to generate orthomaps with infected areas for better decision making. The experiments were carried out on an arbol pepper (*Capsicum annuum* Linnaeus) crop with four separate missions for three weeks to identify the evolution of weeds. The study involved the performance of different tests with the input image size, which exceeded 70% of the mean intersection-over-union (MIoU). In addition, the proposal outperformed DeepLabV3+ in terms of prediction time and segmentation rate. On the other hand, the high segmentation rates allowed approximate quantifications of the infestation area ranging from 0.5 to 83 m². The findings of this study show that the U-Net architecture is robust enough to segment pests and have an overview of the crop.

Keywords: aerial images; weed segmentation; invasive species; digital image processing; deep learning



Citation: Gutiérrez-Lazcano, L.; Camacho-Bello, C.J.; Cornejo-Velazquez, E.; Arroyo-Núñez, J.H.; Clavel-Maqueda, M. *Cuscuta* spp. Segmentation Based on Unmanned Aerial Vehicle (UAVs) and Orthomosaics Using a U-Net Xception-Style Model. *Remote Sens.* **2022**, *14*, 4315. <https://doi.org/10.3390/rs14174315>

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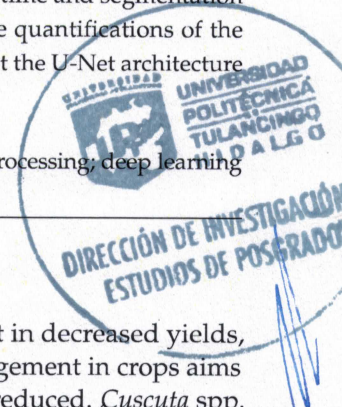
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1. Introduction

Invasive weeds in agricultural fields cause problems that result in decreased yields, affected product quality, and increased production costs. Weed management in crops aims to control invasive species to a level where their economic impact is reduced. *Cuscuta* spp. is included in the list of noxious and invasive weeds in many countries [1]. It is a parasitic plant that affects various crops of agricultural and forestry importance. The Centre for Agricultural Bioscience International (CABI) reports that the species affected are forage legumes, herbaceous plants, shrubs, trees, alfalfa, clover, beans, soybean, blueberry, carrot, citrus, tomato, and grasses [2]. *Cuscuta* spp. is an obligate holoparasitic species that, to complete its life cycle, obtains nutrients, water, and carbohydrates through vascular connections with other plants [3–5]. It is a cosmopolitan species that grows in a wide variety of climates and ecosystems on almost all continents [6]. The weed is native to Asia, Africa, and Europe in the Mediterranean region [7]. *Cuscuta* spp. has more than 170 species distributed worldwide [8], most of which are found in North America in regions with warm and humid climates [9]. In Mexico, more than 60 species have been reported [10] in the states of Baja California Sur, Colima, Mexico City, Guerrero, Hidalgo, Jalisco, Michoacan, Morelos, Oaxaca, Puebla, Querétaro, San Luis Potosi, Sonora, Tamaulipas, and Veracruz [11]. It spreads through the dispersal its seeds and it overgrows, causing massive damage to crop fields. It can cause losses of 50–75% of host crop yields [12]. Losses of 87% have been reported in *Cicer aurantium* crops [13], 60–65% in *Capsicum frutescens*, 31–34% in *Vigna mungo*, 60–65% in *Guizotia abyssinica*, and 87% in *Lens culinaris* [14]. Control of infested crops is





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Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

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ATENTAMENTE



Article

Neural Adaptive Robust Motion-Tracking Control for Robotic Manipulator Systems

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Abstract: This paper deals with the motion trajectory tracking control problem based on output feedback and artificial neural networks for anthropomorphic manipulator robots under disturbed operating scenarios. This class of manipulator robots constitutes nonlinear dynamic systems subjected to disturbance torques induced mainly by work payload. Parametric uncertainty and possible dynamic modeling errors stand for other kind of disturbances that can deteriorate the efficiency and robustness of the tracking of controlled nonlinear robotic system trajectories. In fact, the presence of unknown dynamic disturbances is unavoidable in industrial robotic engineering systems. Therefore, for high-precision applications, such as laser cutting, marking, or welding, effective control schemes should be designed to guarantee adequate motion profile tracking planned on this class of disturbed nonlinear robotic system. In this context, a new adaptive robust motion trajectory tracking control scheme based on output feedback and artificial neural networks of anthropomorphic manipulator robots is presented. Three-layer B-spline artificial neural networks and time-series modeling are properly exploited in the design of novel adaptive robust motion tracking controllers for robotic applications of laser manufacturing. In this way, dependency on detailed nonlinear mathematical modeling of robotic systems is considerably reduced, and real-time estimation of uncertain dynamic disturbances is not required. Furthermore, several cases studies to demonstrate the motion planning tracking control robustness for a class of MIMO nonlinear robotic systems are described. blue insights for the extension of the introduced output-feedback adaptive neural control design approach for other architecture of nonlinear robotic systems are depicted.

Keywords: active disturbance rejection; artificial neural networks; laser manufacturing; manipulator robot; trajectory tracking control



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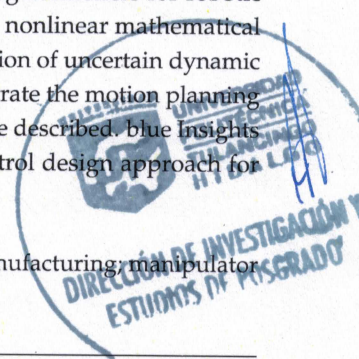
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1. Introduction

The study and application of intelligent control techniques, such as fuzzy logic and neural networks, have gained widespread recognition in recent years. The basis of these techniques consists of learning in a prescribed manner the input–output behavior of a system to subsequently be controlled [1]. The importance of these types of techniques is found in nonlinear systems, variants in time, and those that are subjected to different types of disturbances [2]. Manipulator robots have complex nonlinear dynamics that can make accurate and robust control difficult. In today's manufacturing environments,





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Por medio del presente documento le informo que el proyecto de investigación que lleva por título:

" Capacitation y Desarrollo de Habilidades de los Directores de las mypes de Mineral de la Reforma, Hidalgo, México "

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

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DIRECCIÓN DE INVESTIGACIÓN Y
ESTUDIOS DE POSGRADO

Capítulo 38. Capacitación y desarrollo de habilidades de los directores de las mypes de Mineral de la Reforma, Hidalgo, México

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Resumen

Esta investigación pretende determinar el perfil de competencias directivas que perciben los directores de las mypes del municipio de Mineral de la Reforma y su influencia sobre la capacitación organizacional; así como el contraste con el perfil de otros directores de Latinoamérica. Se trabajó con un enfoque cuantitativo, transversal de alcance correlacional, basado en 85 ítems, que abordan, las características de la empresa, los datos generales del director y las *habilidades directivas*; obtenidos de una encuesta aplicada aleatoriamente a 350 directores, de los cuales 137 son mujeres y 213 hombres. Los resultados indican que, la percepción del empresario sobre su capacidad de gestión para la competitividad, reforzada por la *capacitación* a la que él mismo se sujeta, así como por el énfasis que imprime en la *capacitación* organizacional, muestra una fortaleza significativa en tres de las variables analizadas: delegar, trabajo en equipo y liderazgo. Los empresarios locales se evalúan con un mejor desempeño sobre la *habilidad directiva* de motivación y capacitación que los de Latinoamérica; aunque, la auto-percepción sobre todas las *habilidades directivas* indica que están más de acuerdo en tenerlas, que, en no contar con ellas, en ambas regiones de estudio. Lo que sugiere que las políticas y esfuerzos coordinados de organismos de cada sector, para el desarrollo de conocimiento y tecnologías, detonarían el desarrollo y competitividad de estas entidades. Se concluye que la capacitación u otras estrategias para el aprendizaje organizacional precisan de valorarse como prioritarias por las mypes estudiadas.

Palabras clave:

Capacitación, habilidades directivas, Mineral de la Reforma, Hidalgo y mypes





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" Capacitación y Desarrollo de Habilidades de los Directores de las mypes de Santiago Tulantepec y Cuautepec de Hinojosa, Hidalgo, México "

El resultado de este trabajo, ha sido publicado en una revista de alto impacto.

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ATENTAMENTE



Capítulo 40. Capacitación y desarrollo de habilidades de los directores de las mypes de Santiago Tulantepec y Cuauhtepc de Hinojosa, Hidalgo, México

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<https://www.relayn.org/biblioteca/22.001/T1-C40.pdf>

Resumen

En el presente capítulo se presentan los resultados de la investigación para determinar un perfil general de percepción de competencia de habilidades del personal con funciones directivas y la identificación de la influencia de las habilidades en la percepción del personal directivo respecto a la *capacitación* en las mypes de Santiago Tulantepec y Cuauhtepc de Hinojosa, Hidalgo México. Se trata de un estudio de diseño transversal, cuantitativo, de tipo exploratorio, descriptivo y correlacional. Se aplicó una encuesta que permite recuperar información de la organización, datos del personal directivo y de las *habilidades directivas* considerando las variables *solución de problemas, manejo de conflictos, comunicación, coaching y retroalimentación, motivación, delegar, trabajo en equipo, liderazgo y capacitación*.

Los principales resultados que se obtiene son que las actividades más representativas de las organizaciones consultadas el 63% se dedican al comercio al mayoreo y menudeo y el 14.8% a la industria manufacturera en los municipios considerados, las variables que resultaron significativas corresponden a *solución de problemas, comunicación, coaching y retroalimentación y liderazgo* y que en comparación; resulta relevante considerar que la comparación entre la muestra de los municipios objeto de estudio y la muestra del estudio general presenta significancia en todas las variables a excepción de la correspondiente en delegar, con base en los datos obtenidos las instituciones públicas, privadas y sociales se podrán establecer acciones o programas que puedan apoyar a las organizaciones en el logro de resultados y mejorar en el rendimiento a partir de las *habilidades directivas*.

Palabras clave:

Capacitación, habilidades directivas, Hidalgo y mypes

