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LIST OF ABBREVIATIONS

(HIV): Human immunodeficiency virus	1
(CD4): Cluster of Differentiation 4.....	1
(T-cell) : T Lymphocytes.....	1
(AIDS): Acquired immunodeficiency syndrome	1
(MRI): Magnetic resonance imaging	1
(MR): Magnetic resonance.....	1
(PET): positron emission tomography	1
(SPECT) : single photon emission computerized tomography	1
(MRS) : magnetic resonance spectroscopy,...	1
(fMRI): functional magnetic resonance imaging.....	1
(CAD) : computer-aided detection.....	3
(CDC): the Center for Disease Control	8
(ARC): AIDS Related Complex.....	9
(PGL): Progressive Generalized Lymphadenopathy syndrome.....	9
(ELISA): enzyme-linked immunosorbent assay	10
(CAT) : Computerized Axial Tomography.....	12
(RF): pulses Radio Frequency.....	15
(EM): spectrum ElectroMagnetic	16
(ADC) : AIDS dementia complex	23
(HAD): HIV Associated Dementia	23
(SFVAMC) : San Francisco Veterans Affairs Medical Center.....	23
(ARVs): AIDS Related Viruses.....	24
(NIMH) : The National Institute of Mental Health.....	24
(ANI): Asymptomatic Neurocognitive Impairment	24
(MND): Mild Neurocognitive Disorder	25
(CT) : Computed tomography	25
(EMG): Electromyography	27

(CNS) : central nervous system	27
(rCBF): regional cerebral blood flows	27
(rRBV) : regional blood volume	27
(BOLD): Blood Oxygen Level Dependent	27
(ReHo): Regional Homogeneity.....	28
(PCA): principle component analysis	28
(FNN): forward neural network	28
(ACPSO) : adaptive chaotic particle swarm optimization	28
(SPSS): Statistical Package for the Social Sciences	30
(LCD) : liquid crystal display.	31
(DICOM): Digital Imaging and Communications in Medicine.....	32
(ROI): Region Of Interest.	32
(SGLD): Spatial Gray Level Dependence.....	34

DEDICATION

This thesis is dedicated to all those affected by the HIV\AIDS epidemic, hopefully it may become step in the track of stopping their suffering and saving their life.

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ABSTRACT

Human immunodeficiency virus (HIV) belongs to a subset of retroviruses called lentiviruses (or slow viruses), which means that there is an interval between the initial infection and the onset of symptoms. Upon entering the bloodstream, HIV infects the CD4+ T cells and begins to replicate rapidly. Acquired immunodeficiency syndrome (AIDS) is the final stage of HIV infection. The brain may be affected by a variety of abnormalities in association with HIV infection.

Researchers have found significant damage in the brains of HIV-positive patients whose viral load is effectively suppressed by anti-retroviral therapy; But It is unclear how HIV causes such brain injury.

Understanding these mechanisms is important to develop appropriate neuro-protective interventions for those people in Sudan, Africa and all over the world.

The main core of this thesis is to develop an algorithm which can be used to explore the effect of HIV/AIDS on human brain based on MRI images, Compare the variations of brain cells between normal and abnormal cases and selecting the proper statistical features.

Ten positive HIV/AIDS patients -provided written consent-, with detailed medical history was obtained, On the other hand the same number of cases, gender, age, of negative HIV volunteers, Participate this study at Royal Care International Hospital, Khartoum, Sudan.

In this study, we presented a statistical based method to assess and analyze given MR brain images, it proves that the effectiveness of seventeen's of statistical features derived from forty of statistical features for assessment the normal and abnormal brain tissues on digital MRI.

The statistical features achieved the best results which used for implementation algorithm for brain cell changes detection for positive HIV patients in comparison to negative cases with sensitivity of 83.1%, specificity of 88.1% , positive predictive of 87.5%, negative predictive of 83.9% and the overall performance of 85.6%.

الملخص

فيروس نقص المناعة البشرية (HIV) ينتمي إلى مجموعة فرعية من الفيروسات يسمى الفيروسات البطيئة مما يعني أن هناك فاصل زمني بين الإصابة الأولية وبداية ظهور الأعراض . عند دخول مجرى الدم، فيروس نقص المناعة البشرية يصيب خلايا $CD4 + T$ ويبدأ في تكرار بسرعة . متلازمة نقص المناعة المكتسب (الإيدز) هو المرحلة النهائية من عدوى فيروس نقص المناعة البشرية . قد يتأثر الدماغ عن طريق مجموعة متنوعة من التشوهات مرتبطة بالإصابة بالفيروس . وقد وجد الباحثون أضرار كبيرة في أدمغة المرضى المصابين بالفيروس الذين قمعت بشكل فعال من العلاج المضاد للفيروسات الرجعية الحمل الفيروسي . لكن من غير المفهوم كيف يسبب هذا الفيروس هذه الإصابات بالدماغ . فهم هذه الآليات مهم لتطوير التدخلات العصبية وافية مناسبة لهؤلاء الناس في السودان وأفريقيا وجميع أنحاء العالم . الجوهر الرئيس من هذه الرسالة هو تطوير خوارزمية يمكن استخدامها لاستكشاف تأثير فيروس نقص المناعة البشرية / الإيدز على الدماغ البشري مبنية على صور الرنين المغناطيسي، ومقارنة الأشكال المختلفة من خلايا المخ بين الحالات العادية وغير العادية واختيار الميزات الإحصائية المناسبة . شارك في هذه الدراسة عدد عشرة مرضى مصابين بفيروس نقص المناعة البشرية / الإيدز إيجابي -موقعين بالموافقة المكتوبة على تعهد بموافقتهم على انها بغرض البحث العلمي، مع الحصول على التاريخ المرضي المفصل، وبالمقابل على نفس العدد من الحالات، النوع والعمر عشرة من المتطوعين غير مصابين بالفيروس، شاركوا في هذه الدراسة بمستشفى رويال كير العالمية، الخرطوم، السودان . في هذه الدراسة، قدمنا طريقة إحصائية استناداً إلى تقييم وتحليل الصور الرنين المغناطيسي للدماغ، فإنه أثبت ان سبعة عشر من الميزات الإحصائية المختارة من أربعين من الميزات الإحصائية هي من الفعاله بمكان لتقييم أنسجة المخ الصحيحة عن المصابة وذلك عند التصوير بالرنين المغناطيسي الرقمي . الميزات الإحصائية تحقق أفضل النتائج والتي تستخدم لتطبيق خوارزمية تغييرات خلايا الدماغ في الكشف عن المرضى بفيروس نقص المناعة البشرية بالمقارنة مع الحالات الغير مصابة وذلك بنسبة حساسية بلغت 83.1% ، وخصوصية 88.1% ، والتوقع الإيجابي 87.5%، والتوقع السلبي 83.9% و الأداء العام 85.6%.