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MACHINELEARNINGCLASSIFICATIONUSINGMOTIF BASED GRAPH DATABASES CREATED FROM UWF-ZEEKDATA22

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ABSTRACT

This study uses motif-based graph databases to visualize and classify tactics in the MITRE ATT&CK framework. Machine Learning classification models, capable of detecting Reconnaissance network attack tactics, labeled as per the MITRE ATT&CK framework, are created for the newly created UWFZeekData22 dataset. The work analyzes Zeek Connection logs.Featureselectionisperformedusinggraphmotifs.Resultsshowthatmodelperformance can be increased using various network graph motifs. Upon completion of this work, it was concluded that, of the motifs used, the Star motifperformed the best; and, the most important feature for predicting Reconnaissance network attacks within the Zeek Connection Logs datasetwasthe“From”feature,orSourceIP,whichrepresentsthenetworkaddressfromwhere theconnectionisoriginating.Itwasalsodeterminedthat,irrespectiveofwhichmotifwasused to train the model, the Decision Tree algorithm performed best.

KEYWORDS

GraphDatabases,Motifs,StarMotif,Reconnaissance,MachineLearning,Cybersecurity, Visualizing attacks

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THEORDEROFNUMBERSANDTHEGOLDBACH CONJECTURE

JacquelineWötzel

ABSTRACT

In the following will be regard the potentiality of order of numbers for the ternary Goldbach conjecture, where he claimed that “every number… is an aggregate of three prime numbers”. Theorderofnumbersillustratesthepossiblecombinationsofprimenumbersforthegeneration of all natural (integer) numbers. Two ways to decompose a natural number in a sum of prime numbers areillustrated. Goldbach`s ternaryconjecture can be confirmed in this way. A binary addition is also possible and requires that a summand be a product with a prime number.

KEYWORDS:

Numbertheory,Orderof integernumbers,Goldbachconjecture

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THEORDEROFNUMBERSANDTHECOLLATZPROBLEM

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ABSTRACT

The algorithm of Collatz is also known the 3n+1 problem. It will be started with any uneven naturalnumber(n).Thisnumberistotripleandaddone.Thendividebytwoasoftenaspossible, if the number is even. If the number is odd, use again the 3n+1 step. The conjecture of the Collatz problem is that these operations always reach 1, no matter which positiveinteger is chosen to start the algorithm. A view to an order of numbers gives an explanationfor the dominanceofdegressivestepstoreach1.Theideatoidentifytheorderofnumbersisdeveloped from an interview of Dr. Peter Plichta where he spoke on his book “Das Primzahlenkreuz”.

KEYWORDS

Numbertheory,Orderofintegernumbers,Collatzproblem

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ORDEROFINTEGERNUMBERSANDSTRUCTUREOF PRIME NUMBERS

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ABSTRACT

There are many theories and trials exist to find a structure for identification and prediction of prime numbers. The famous one is the Riemann Hypothesis. Beside this, there are running competitions to identify the prime numbers for enormous range of numbers with high performance computers. The idea to identify a structure in prime numbers is developed from aninterviewofDr.PeterPlichtawherehespokeonhisbook“DasPrimzahlenkreuz”.Following is given a scheme that uses steps of separation to generate an order, which allows simple elimination steps to identify and predict prime numbers.

KEYWORDS

NumberTheory,PrimeNumbers

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COVID-19CHESTX-RAYIMAGES:LUNGSEGMENTATION AND DIAGNOSIS USING NEURAL NETWORKS

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ABSTRACT

COVID-19hascausedworld-widedisturbancesandthemachinelearningcommunityhasbeen findingwaystocombatthedisease.Applicationsofneuralnetworksinimageprocessingtasks allow COVID-19 Chest X-ray images to be meaningfully processed. In this study, the V7 Darwin COVID-19 Chest X-ray Dataset is used to train a U-Net based network that performs lung-regionsegmentationandaconvolutionalneuralnetworkthatperformsdiagnosisonChest X-rayimages.ThisdatasetislargerthanmostofthedatasetsusedtodevelopexistingCOVID-19relatedneuralnetworks.Thelungsegmentationnetworkachievedanaccuracyof0.9697on the training set and an accuracy of 0.9575, an Intersection over-union of 0.8666, and a dice coefficient of 0.9273 on the validation set. The diagnosis network achieved an accuracy of 0.9620 on the training set and an accuracy of 0.9666 and AUC of 0.985 on the validation set.

KEYWORDS

COVID-19,ChestX-rayImages,Diagnosis,LungSegmentation,NeuralNetworks

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SIMULATIONOFPIPELINEDMIPSFLOATING-POINT UNITS USING NODE-RED

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ABSTRACT

The pipelined processor architecture is the best way to increase instruction-level parallelism, and thus, understandingitsoperationisoneofthekeysincomputerarchitecturelearning.Tohelpwiththeleaning process,wehavedevisedaseriesofpipelinesimulationmethodologies.Thisarticlepresentsoneofthem – a simulation methodology of hazard detection and forwarding in MIPS32 pipelined floating-point units.OurimplementationapproachisusingtheNode-REDprogrammingenvironment,anevent-driven dragand-drop system for designing data flows with business logic. In addition, to implement sophisticatedoperationsnotsupportedbyNode-RED,wealsoemployWebAssemblycodeandtheRust language. We simulate not only the standard 5-stage pipelined MIPS ISA but also pipelined (addition, subtraction,andmultiplication)andunpipelined(division)floating-pointoperations.Ourstudyfocuses mainlyonhazarddetection,whichisrequiredtoensureprogramcorrectness,aswellasforwardingused to improve system performance. Lastly, we design a dashboard interface to visually represent the pipelinestagesandCPUstatusduringexecution.Usingthedashboardinterface,MIPS32machinecode canbeloadedintooursimulatorfromhexadecimaltextfiles.Weverifiedthatoursimulatorishandling hazard detection and forwarding correctly. A screenshot of the dashboard interface is included that shows all the stages of floating-point pipelines.

KEYWORDS

InstructionSetArchitecture,Pipelining,HazardDetection,Forwarding,Floating-Point Operations, Microprocessor Simulation, MIPS32.

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DECADESOFMISCOMPUTATIONINGENOMICCLADES AND DISTANCES

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ABSTRACT

Hardly a week seems to go by without encountering a new genetics study that contains a diagram of specimen genetic similarities and clades. For these diagrams, biologists have long relied on university based and/or commercial computational packages which are not only prone to pilot errors but also contain "analysis" methods which should never be used for genetic distance or clustering. Not that all the software is poor – it appears there is a mixture of good and bad in each package. The troublesome methods, however, have enjoyed acceptable use for so long that serious errors are published on a frequent basis. What follows is a list of concerns thatwill hopefullybe useful toauthors and reviewers alike. The report concludes with a graph-theoretical alternative to the current status quo in genomics.

KEYWORDS

Bayesianclustering,Graphpartitioning,Missingvalues,Pairjoining,Pseudo-metrics.

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LOWALPHA,LOWBETA,ANDTHETABRAINWAVES BANDSTOPREDICTSTUDENTENGAGEMENTUSING MACHINE LEARNING METHODS

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ABSTRACT

Recent developments in Brain-Computer Interface technologies have increased the ability to personalize Learning by detecting and recognizing participants' cognitive and emotional affective states. From a global point of view, working in monitoring and identifying the emotional and cognitive states of the students will establish the basis to incorporate a higher level of academic supervision and control of student performance. In this paper, the authors used an Open EEG (Electroencephalography) Dataset to analyze the correlation between studentbrainwavesinthefrontallobewhenwatchingvideoscategorizedinlevelsofconfusion by using Machine Learning algorithms. It was found that alpha1, beta1, and theta bands are highest correlated to confusion with p=0.012, p=0.085, and p=0.0016, respectively. A comparisonbetweensomealgorithmsshowedthattheConvolutionalNeuralNetwork(CNN) + LSTM Model presented 75% highest accuracy. Furthermore, the level of student cognitive engagement was computed, in terms of those three brainwaves, obtaining a p= 0.625. The resultssuggestthatMachineLearningisapowerfultoolforanalyzingbrainactivity.Thispaper contributes to neurosciences applied to Personalized Learning.

KEYWORDS

CognitiveLoad,TaskComplexity,Confusion,Engagement,EEG,MachineLearning, Personalized Learning.

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EstimatingTheDistributionOfWitnessesOfThePrimality Of The Miller-RabinTest

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ABSTRACT

This article investigates the error distribution of the Miller-Rabin test for the class of triple prime numbers. At first the current results on the class of semi primes are presented. Further, a theoretical estimationoftheaveragefrequencyfortripleprimenumbersonanintervalisderived,andacomparative analysis with a practical result is demonstrated. Graphs and intermediate conclusions accompany all comparisons. A conclusion is also made about a possible direction for improving this estimation.

KEYWORDS

Miller-Rabintest,strongpseudoprime, numbertheory,frequencydistribution

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VIDEOSEGMENTATION&SUMMARIZATIONUSINGMODIFIED GENETIC ALGORITHM

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ABSTRACT

Video summarization of the segmented video is an essential process for video thumbnails, video surveillanceandvideodownloading.Summarizationdealswithextractingfewframesfromeachscene and creating a summary video which explains all course of action of full video with in short duration of time. The proposed research work discusses about the segmentation and summarization of the frames.Ageneticalgorithm(GA)forsegmentationandsummarizationisrequiredtoviewthehighlight of an event by selecting few important frames required. The GA is modifiedto select only key frames for summarization and the comparison of modified GA is done with the GA.

KEYWORDS

Videosegmentation, videosummarization,GeneticAlgorithm,videostreams

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