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Centurion University of Technology & Management

Department of Civil Engineering, Paralakhemundi

Workshop, February – 2023

Brief about the Workshop

The Department of Civil Engineering and Centre for Data Science & Machine Learning of CUTM organized a workshop entitled “**Advancement in trend analysis of time series datasets**” on **25/02/2023**., from 2.00pm to 5.00pm in Zoom Platform.

Resource persons/Trainers

1. Dr. Jayanta Das, Assistant Professor at the Department of Geography in Rampurhat College, University of Burdwan, West Bengal, India.

About the Speaker

His research interest includes agricultural modelling and sustainable management studies, groundwater, flood, drought analysis, climate change, watershed management, hydrological modelling, water quality, geospatial data analysis, data mining, and GIS applications with more than 15 academic years of experience. Dr. Jayanta Das has published more than 30 scholarly articles in peer-reviewed journals, focusing mainly on: climate change, agricultural suitability analysis, natural and man-made hazards analysis, risk management, and spatial data analysis. Recently, Dr. Das has published an edited book entitled Monitoring and Managing Multi-hazards: A Multidisciplinary Approach jointly with Dr. Sudip Kumar Bhattacharya from Springer Nature.

What you get from this Workshop: Practical Coding Session + E-Certificate + Session Recordings

Venue: Online Mode (Zoom Link)

Objective and outcome of the Workshop

The overall workshop session was very much informative and hands on experience. The speaker’s way of Hands on demonstration was crystal clear and the participants were engaged in an interactive conversation. The Speaker discussed how time series analysis has been broadly adopted in scientific research and engineering applications. Many theoretical developments and new methods for time series analysis have significantly contributed to the understanding of complex systems. The Speaker also discussed how time series analysis helps organizations understand the underlying causes of trends or systemic patterns over time. Using data visualizations, business users can see seasonal trends and dig deeper into why these trends occur. With modern analytics platforms, these visualizations can go far beyond line graphs. The Speaker showcased a practical way of working with 30 years’ time series datasets using software’s like R-Studio, Excel and Jupyter Notebook. The participants were overwhelmed the way speaker was engaging everyone’s queries with utmost patience and clear description. The Speaker avoided any PPT presentation and totally focused on arranging the datasets and working practically on it with showing how to overcome errors and get the desired output. The Speaker also showcased his publication using these methodologies and motivated participants to work in collaboration. The Speaker discussed the following points:

Comparing parametric and non-parametric methods

Mann Kendal method, Autocorrelation function, Modified mann Kendal, Innovative trend analysis and Rho



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algorithm

No of Participants: 70 participants (includes Students and Faculties from our University and outside Universities) joined the online Zoom platform.

Photographs of the Workshop

The screenshot shows a Zoom meeting interface. The main window displays the SPSS Statistics Viewer with a 'Nonparametric Correlations' output. The output shows a correlation matrix for 'Spearmen's rho' across months from Jan to Dec. The matrix is lower triangular, with the diagonal representing the correlation of each month with itself (all 1.000). The values for other months are: Jan (0.000), Feb (-0.218), Mar (-0.194), Apr (-0.048), May (-0.053), Jun (0.284), Jul (0.197), Aug (0.354), Sep (0.258), Oct (0.366), Nov (0.388), Dec (-0.052), Annual (-0.126). The sample size (N) for each month is 36. The significance level (Sig. (2-tailed)) is 0.992 for Jan, 0.002 for Feb, 0.002 for Mar, 0.002 for Apr, 0.002 for May, 0.002 for Jun, 0.002 for Jul, 0.002 for Aug, 0.002 for Sep, 0.002 for Oct, 0.002 for Nov, and 0.002 for Dec. The overall significance level is 0.000.

On the right side of the Zoom window, there is a 'Participants (71)' list. The list includes the following names and initials:

- SS Saif Said
- SK Sakthi Kiran
- S Shradhanjalee
- shyam lochan bora
- SG Sohaila Ghulami
- S SONU KUMAR
- SM Subrata Maity
- SK sudhir kumar
- S SUJOY
- Sushmitra 1996
- TP Thallam Prashanth
- V Venkatesh
- VK Vibhesh kumar Prasad
- BS Biswajit Singh(190101110003)

The Zoom meeting controls at the bottom show 71 participants, chat, share screen, record, reactions, and apps buttons. The system tray at the bottom shows the date and time as 2:55 PM on 2/25/2023.



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Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1979	10.206985130	6.693081674	.000000000	3.512192090	4.243467139	135.14384010	376.0800789	514.0210947
1980	19.317064140	4.811665601	34.220695760	8.916089652	12.665931200	492.96605540	604.4488463	499.1432270
1981	49.483115810	28.415103570	58.694465160	43.747910320	100.284540600	246.30320720	623.4002864	850.1734269
1982	14.213565580	92.072293270	99.873432020	24.225710800	5.230524125	130.68406650	316.0927269	623.7788241
1983	23.682404170	84.121797910	13.417061310	151.063789700	57.794953440	189.62572100	431.4262289	641.9225990
1984	29.335220470	12.953564450	.000000000	16.680155000	222.008817300	256.731608000	565.3100637	408.0279362
1985	27.101896030	33.291149120	.109863295	6.092264153	8.103277116	158.856329300	450.9012381	494.2088474
1986	12.751007650	27.900125090	4.882050144	8.775327924	3.779986270	417.58687490	624.5830601	443.0339730
1987	23.3940009610	1.451396966	22.810366290	34.308251430	7.741931472	11.36227078	357.1243274	243.1360177
1988	.0000000000	72.681432190	4.506114442	44.621670590	13.471982150	597.071646200	510.8144369	635.2775966
1989	.377654774	.058364856	1.126098648	.000000000	276.857147800	486.03593770	631.5104518	868.5223559
1990	.027465833	62.631504860	112.252802600	65.578080930	179.940596600	595.47788470	606.0058270	572.0134590
1991	42.644120770	3.429795931	57.933150880	30.327413790	9.254269426	360.46314620	468.0639423	579.8849129
1992	18.881036490	24.132160190	.092697142	10.917661870	68.608770040	302.75404750	303.2484048	457.9367227
1993	.017166132	.096130354	27.761087400	91.857778880	120.688223000	528.20210090	420.3892851	430.6756894
1994	23.550205640	49.594699090	.044631965	25.209324650	64.457986510	258.48938180	678.7723631	665.6534342
1995	37.00323950	55.520444210	71.212037180	43.687811710	260.331387200	174.29637240	450.3295966	535.9457233
1996	24.600796650	12.745858280	17.839904320	10.953709370	25.594710040	418.47870110	481.6166342	501.7688589
1997	16.069223160	3.501892764	11.839485630	36.985307110	24.286638730	289.03310950	626.8353222	777.5057520
1998	254.11728500	63.010884900	163.432800800	92.163255460	160.286422800	627.47121750	472.3090853	517.1152798
1999	.0000000000	.0000000000	.0000000000	.0000000000	80.478257700	295.09875690	380.0703082	521.1038964
2000	.281524644	44.031137090	.044631965	13.130380050	22.348599710	455.40217400	374.4939011	512.4255337
2001	.0000000000	5.482009800	38.665866060	17.518895520	33.087249000	580.60600380	628.4865668	608.9636438
2002	24.447153930	.0000000000	19.535063940	17.045972640	10.291102000	166.8033410	431.3120037	631.1757195
2003	.880622935	17.543787220	52.916338590	38.919075420	8.651731558	382.63665450	747.4934812	639.6901899
2004	6.496522790	15.334511180	6.057069451	26.599790260	8.432006861	296.61543640	522.9689859	682.0235759
2005	20.683482670	2.598951492	30.473320680	26.727663000	15.167146470	153.00864670	559.6126500	262.8564543

Zoom Meeting

Participants: Sai Vikas K, arvind, Anand, alok kumar, Anil Kumar

Recording

Participants (68)

Find a participant

Participants list: bibhuti (Me), SOVAN SANKALP (Host), Jayanta Das (Co-host), Abhinav Anand, Aditya kumar, alok kumar, Anand, Anil Kumar, Ankit kumar, ARUN KUMAR, arvind, ASIT, Bablu Kumar, Bikram Narayan, Binod Kumar (Binod), Biswajit Minji, Biswajit Singh(190110110003)

Slide Content:

in section 11 to the test.

2. The original Mann-Kendall trend test (Kendall, 1955) for two sets of observations $X = x_1, x_2, \dots, x_n$ and $Y = y_1, y_2, \dots, y_n$ is formulated as follows. The statistic S is calculated as in Eq. (1):

$$S = \sum_{i < j} a_{ij} b_{ij} \quad (1)$$

where

$$a_{ij} = \text{sgn}(x_j - x_i) = \begin{cases} 1 & x_i < x_j \\ 0 & x_i = x_j \\ -1 & x_i > x_j \end{cases} \quad (2)$$

and b_{ij} is similarly defined for the observations in Y . Under the null hypothesis that X and Y are independent and randomly ordered, the statistic S tends to normality for large n , with mean and variance given by:

$$E(S) = 0 \quad (3)$$

$$\text{var}(S) = n(n-1)(2n+5)/18 \quad (4)$$

If the values in Y are replaced with the time order of the time series X , i.e. $1, 2, \dots, n$, the test can be used as a trend test (Mann, 1945). In this case, the statistic S



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The screenshot shows a Zoom meeting interface. At the top, the meeting title is "Zoom Meeting" and the recording status is "Recording". The top bar displays the names of five participants: Sai Vikas K, arvind, Anand, alok kumar, and Anil Kumar. The main content area shows a presentation slide titled "Kendall trend test". The slide text includes:

i.e. there is no trend or serial correlation structure among the observations. However, in many real situations the observed data are autocorrelated. The autocorrelation in observed data will result in misinterpretation of trend tests results. Cox and Stuart (1955) state that: 'Positive serial correlation among the observations would increase the chance of significant answer, even in the absence of a trend.' A closely related problem that has been studied is the case where seasonality exists in the data (Hirsch et al., 1982). By dividing the observations into separate classes according to seasons and then performing the Mann-Kendall trend test on the sum of the statistics from each season, the effect of seasonality can be eliminated. This modification is called the seasonal Kendall test (Hirsch et al., 1982; Hirsch and Slack, 1984; Zetterqvist, 1991). Although the seasonal test eliminates the effect of dependence between seasons, it does not account for the correlation in the series within seasons (Hirsch and Slack, 1984). The same problem exists when yearly data are analyzed, since they are often significantly autocorrelated.

In this paper, theoretical results are presented about the evaluation of the mean and variance of the Mann-Kendall trend test statistic in the presence of autocorrelation. Based on these theoretical results, as well as on an empirical approximation, a modified Mann-Kendall trend test which is robust in the presence of autocorrelation is suggested and its empirical significance level and power are investigated.

2. The original Mann-Kendall trend test

The rank correlation test (Kendall, 1955) for two sets of observations $X = x_1, x_2, \dots, x_n$ and $Y = y_1, y_2, \dots, y_n$ is formulated as follows. The statistic S is calculated as in Eq. (1):

$$S = \sum_{i < j} a_{ij} b_{ij} \quad (1)$$

where

$$a_{ij} = \text{sgn}(x_j - x_i) = \begin{cases} 1 & x_i < x_j \\ 0 & x_i = x_j \\ -1 & x_i > x_j \end{cases} \quad (2)$$

and b_{ij} is similarly defined for the observations in Y . Under the null hypothesis that X and Y are independent and randomly ordered, the statistic S tends to normality for large n , with mean and variance given by:

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If the values in Y are replaced with the time order of the time series X , i.e. $1, 2, \dots, n$, the test can be used as a trend test (Mann, 1945). In this case, the statistic S

The right side of the screenshot shows a list of 68 participants, including bibhuti (Me), SOVAN SANKALP (Host), Jayanta Das (Co-host), Abhinav Anand, Aditya kumar, alok kumar, Anand, Anil Kumar, Ankit kumar, ARUN KUMAR, arvind, ASIT, Bablu Kumar, Bikram Narayan, Binod Kumar (Binod), iswajit Minji, and iswajit Singh(190101110003). There are "Invite" and "Unmute Me" buttons at the bottom of the participant list.

Brochure:



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A ONE-DAY WORKSHOP ON ADVANCEMENT IN TREND ANALYSIS FOR TIME SERIES DATASETS

SPEAKER



DR. JAYANTA DAS
ASSISTANT PROFESSOR,
RAMPURHAT COLLEGE
WEST BENGAL, INDIA
PUBLICATIONS- 40+
CITATIONS- 300+

WORKSHOP LEARNINGS

*COMPARING PARAMETRIC AND
NON-PARAMETRIC METHODS*

1. *MANN KENDAL METHOD*
2. *AUTOCORRELATION FUNCTION*
3. *MODIFIED MANN KENDAL*
4. *INNOVATIVE TREND ANALYSIS*
5. *RHO ALGORITHM*

Registration Fees



7008038833
(Sovan Sankalp)

Session Recordings will be provided to participants

**COORDINATORS: DR.PRAFULLA KUMAR PANDA,
SOVAN SANKALP & DR.BIBHUTI BHUSAN SAHOO**

ORGANIZED BY:

**DEPARTMENT OF CIVIL ENGINEERING & CENTRE FOR DATA SCIENCE AND
MACHINE LEARNING**

**CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA,
INDIA**

Sovan Sankalp.

(Workshop Coordinator)

Panda

(Workshop Coordinator)