



**Parkland College**  
**Arba Minch**  
**Short Term Trainings Programs**

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**Scan Distribution Theory and its Applications using SaTScan**

**About the Course**

SaTScan is a free software that analyzes spatial, temporal and space-time data using the spatial, temporal, or space-time scan statistics.

This training course concentrates on applications of the different types of scan statistics using SaTScan™ software. Mainly this part of the course is designed for researchers in many medical and health science, and applied fields, and is written from the point of view of methodology and applications of the scan statistics. Applications of a wide variety of scan statistics to fields ranging from public health, epidemiology, biology, molecular biology, quality control, reliability, and other fields are illustrated. This part of the course also brings together and reviews the statistical and mathematical approaches used to develop exact and approximate results for the scan statistics.

**Course Duration**

- 6 Days at 8 hours a day

**Course Learning Outcomes**

After studying this course, you should be able to:

- Understand the SaTScan Software application
- Run SaTScan and analyse data
- Enter basic data into SaTScan
- Understand and analyse Purely Spatial Scan Statistic
- Understand and analyse Space-Time Scan Statistic
- Understand and analyse Space–Time Permutation Scan Statistic
- Interpret SaTScan outputs

**Course Outline**

**1. Purely Spatial Scan Statistic**

- 1.1 Introduction
- 1.2 Poisson and Bernoulli Models
- 1.3 Likelihood ratio test
- 1.4 Properties of the Test Statistic
  - 1.4.1 Detection versus inference
  - 1.4.2 Power
- 1.5 Computations and Monte Carlo Sampling
- 1.6 Limitations of Repeated Purely Spatial Analyses
- 1.7 Applications



- 1.7.1 Illustrate the Purely Spatial Poisson Scan Statistic models using New York State Cancer Incidence Data
- 1.7.2 Illustrate the Bernoulli Spatial Scan Statistic models using the New York State Birth Defect Data
- 2. Space-Time Scan Statistic**
  - 2.1** Introduction
  - 2.2** Poisson Model versus Negative Binomial Distribution
  - 2.3** Prospective Poisson Space-time Scan Statistic
    - 2.3.1 Testing for Clustering: Detecting emerging clusters
    - 2.3.2 Time periodic surveillance
  - 2.4** Applications
    - 2.4.1 Illustrate the model and Evaluating Cluster Alarm using data on Brain Cancer Incidence in New Mexico
    - 2.4.2 Illustrate rapid surveillance and detecting and evaluating emerging clusters using data on COVID-19 patients in Ethiopia
- 3. Space-Time Permutation Scan Statistic**
  - 3.1** Introduction
  - 3.2** Hyper-geometric distribution
  - 3.3** Poisson generalized likelihood ratio
  - 3.4** Monte Carlo hypothesis testing
  - 3.5** Missing Data
  - 3.6** Application
    - 3.6.1. Prospective Time Periodic Geographical COVID-19 Surveillance in Ethiopia using a Space-Time Scan Statistics: Detecting and Evaluating Emerging Clusters
- 4. Miscellaneous Models in Scan Statistic**
  - 4.1** Ordinal Scan Statistic for Identifying Unusual Cancer Stage Patterns
  - 4.2** Multinomial Scan Statistic for Identifying Unusual Population Age Structures
  - 4.3** The Knox method and other tests for space-time interaction
  - 4.4** Power comparisons for disease clustering tests: Computational Statistics and Data Analysis
  - 4.5** Evaluating disease outbreak detection methods: Benchmark data and power calculations
  - 4.6** Bayesian Network Scan Statistics for Multivariate Pattern Detection

### **Target Participants**

The intended audience for this training activity is Statisticians, Biostatisticians and Researchers including Epidemiologist, Biologists, Clinicians, Laboratory and Health professionals with the following prerequisite.

### **Prerequisites**

No prior working knowledge of SaTScan software is required for this course. Understanding of the basic statistical/ bio-statistical concepts, basic computer operational skills and data intuition are required.

### **Training Approach**

This training on Scan Distribution Theory and its Applications is delivered by our seasoned trainers who have vast experience as expert professionals using SaTScan Software. The course



is mainly focused on step-by-step practice for SaTScan Software and taught through a mix of practical activities, theory and group works.

Training manuals and additional reference materials are provided to the participants.

### **Certification**

Upon successful completion of this course, participants will be issued with a certificate.

### **Tailor-Made Course**

We can also do this as a tailor-made course to meet organization-wide needs. A training needs assessment will be done on the training participants to collect data on the existing skills, knowledge gaps, training expectations, and tailor-made needs.