Brainstorm: Statistics and Technology (“Technology Day”)

Distributions

Normal / Gaussian
t-distribution
Poisson
Binomial
Exponential
Uniform
F-distribution
Chi-squared
Dirac / point mass
Wishart
Negative binomial
Gamma dist’n
Beta dist’n
Log-normal dist’n
Weibull
Pareto
Laplace

Statistical Models

Linear Model
Multiple Linear Model/Regression
Logistic model
GLM - generalized linear model
Hierachical models e.g., mixed effects models
Gaussian mixture models
Cox proportional hazards model (Weibull)
ARIMA etc.
Gaussian processes (latent models)
Hidden Markov models
Generalized Additive models (GAMs)
Ridge regression; lasso; elastic net
Tree models, (random) forest models
GLMMs - generalized linear mixed models
Bayesian models (generally)
(k-nearest neighbour)
Copula models
Neural networks

Methods of estimation

MLE - maximum likelihood estimation
least squares
Minimum distance
Method of moments
Expectation-maximization (EM algorithm)
Bayesian estimation
Robust estimation (Huber function, M-estimation, etc.)
lasso / ridge / elastic net

Hypothesis testing

t-test
ANOVA - analysis of variance
Spearman ranking (correlation)
Wilcoxon
ANCOVA, MANOVA
Chi-squared (10s)
F-test
Mann-Whitney
Kruskall-Wallis
Likelihood ratio test
Wald
Score
Komolgorov-Smirnov
Shapiro-Wilk
Fisher’s exact
Permutation test
Difference in proportions test
Goodness-of-fit test

Technologies (in molecular biology)

High throughput sequencing
Fluorescence microscopy
Flow cytometry
Immunoprecipitation
Mass spectrometry
Western blot (Northerns, Southerns)
Microarrays
ELISA
rtPCR / qPCR
RNA sequencing
Electron microscopy
ChIP sequencing
NMR
Multi-electrode array
ATAC-seq
GC/LC mass spec
Electrophysiology (patch clamp, etc.)
Exome sequencing
Single cell sequencing
EPR
Fluorescence in situ hybridization
Bisulphite sequencing
(Imaging) Mass cytometry
Spatial transcriptomics

Applications

Genetic relationships
Differential gene expression - disease versus health
Mutation detection
Cell states
Drug screening
Biomarker detection/discovery (various variants)
Epigenetics -- related to gene expression/regulation
Disease detection (genetic variants); genotyping
Serotyping (viruses)
Tumour subclonal analysis
Staining proteins/areas of interest
Molecular imaging -- compound development
Enrichment (capture) of specific proteins/cells
Protein structure/docking/binding
Personalized medicine
Quality control (in production assays)
Evolution

Linking technology -> applications -> statistics

Technology	**Applications**	**Statistics**
RNA sequencing	Gene expression profiling	Negative Binomial regression