Brainstorm: Statistics

Distributions

Gaussian
Beta
Uniform
Laplace
Poisson
Exponential
Gamma
Bernouli
Binomial
Geometric
Chi-squared
Negative Binomial
(Categorical)
Student’s t
Hypergeometric
Dirichlet
F distribution
Weibull / log-Normal / Pareto (heavy tailed)
(Multivariate ..)
Cauchy
Triangular dist’n

Statistical Models

Bayesian Network
(General) Linear Model
Linear Mixed (Effects) Models
Generalized Linear Model
Mixed Distribution Models
Non-linear models
Smoothing splines
Markov chain models
Hidden Markov Models
Interpolated Markov models
Penalized linear models (ridge / lasso / elastic net)
GAMs (generalized additive models)
auto-regressive models (ARIMA)
Markov processes
Survival models: Cox regression, ..
Difference-to-difference models
Clustering models
ML: neural networks, boosting, SVMs, ..

Methods of estimation

MLE (maximum likelihood estimation)
MM (method of moments)
MAP (maximum a posteriori) / Bayesian estimation
EM (expectation maximization)
vertical and rectangular (..)
RMSE (root mean square error) / least squares
forward backward propagation
cross-validation
imputation
GANs (general adversial models)
Penalized linear models (ridge / lasso / elastic net)
MCMC - Markov Chain Monte Carlo (Bayesian estimation)
common / particle filter
silhouette widths
generalized estimating equations
Fisher scoring
Partial least squares
cross entropy

Hypothesis testing

t test
F test
ANOVA
likelihood ratio test
chi-squared test
LM test (?)
Shapiro (test of variances)
Wilcoxon / Mann-Whitney tests
Fisher’s exact
Z test
Pearson correlation
Bayesian information criterion (BIC)
Score test
Wald test
Difference-in-proportions test
Permutation tests

Technologies (in molecular biology)

1st: Sanger
2nd: SBS (Illumina, ..)
3rd: Oxford Nanopore / PacBio
DNA microarrays
CRISPR / talons / .. - DNA editing
PCR (digital droplet PCR)
High-throughput sequencing
RNA sequencing (single cell / bulk)
ATAC seq (open chromatin)
ChIP seq (DNA binding)
Ribosome profiling
X-ray crystallography
Proteomics (mass spectrometry ..)
Metabolomics (GCMS)
HPLC / NMR
Immunostaining
Cryo-EM
Confocal microscopy
Atomic force microscopy
Two-photon microscopy
Light sheet microscopy
Spatial transcriptomics - 10x Visium / Xenium
Multiplexed imaging
Flow (/mass) cytometry
Protein interactions - BioID, yeast 2 hybrid, TAP tagging, crosslinking, aptamers ..
in vitro testing
HiC

Applications

Determine protein structures
Determine DNA sequence - gene mapping, identifying variation (e.g., GWAS), genome assembly, metagenomics, evolutionary analyses, ..
Differential gene expression analysis e.g., disease/normal comparisons
Copy number variation
Biomarker discovery
TF regulation, gene regulation
Cell development, aging
Cell therapies
Subcellular gene expression analyses
Understanding diversity of cell populations (sorting them); subtyping (immune cells)
Cytometry: cell states (based on marker expression)
Genome organization

Linking technology -> applications -> statistics

Technology	**Applications**	**Statistics**
RNA Sequencing	Differential Gene Expression	Nexgative Binomial Regression