RNAnet a Map of Human Gene Expression

http://bioinformatics.essex.ac.uk/users/wlangdon/rnanet/

This web site is free and open to all users and there is no login requirement

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RNAnet provides a bridge between two widely used Human gene databases. Ensembl describes DNA sequences and transcripts but not experimental gene expression. Whilst GEO contains actual expression levels from many thousands of Human samples but, although samples in GEO can be queried by experiment, comparison across the whole of GEO is not supported. RNAnet provides immediate access to thousands of Affymetrix HG-U133 + measurements provided by GEO covering Human genes in most medically interesting tissues. Data have been quantile normalised and scanned for a variety of common GeneChip errors. There are copious links back into GEO and Ensembl.

Without RNAnet comparison across experiments in GEO is very labour intensive requiring down loading and manual cleaning of data files for each microarray in each experiment. Previously normalising more than a few dozens GeneChips was tricky. Having downloaded tens of thousands of microarray datasets, before RNAnet, we could normalise all HG-U133 + in ten hours. With RNAnet anyone can access cleaned quantile normalised data in seconds.

Further, since we have data from across many different tissues and medical conditions GEO data can be used to find patterns of co-expression. RNAnet shows that the network of strong correlations is huge but sparse. Thousands of genes interact strongly with thousands of others. Conversely, tens of thousands of genes interact strongly with less than 100 others. I.e. RNAnet gives new views for RNA Systems Biology. It builds on free but very valuable databases.

2. INTERACTIVE CORRELATION HEAT MAPS

The web site contains many tens of thousands of pre-calculated heat maps for Mouse, Arabidopsis, Rice and Soybean, as well as Human. For Human genes, RNAnet also supports flexible interactive construction of correlation heat maps. Any set of probes can be correlated either if the probes map in sense, antisense or in both directions to the exon. The probes can be from the same or different probesets and the heat maps can be of any size. Typically 10 × 10 correlation takes about a second to calculate and display. Again GeneChip data may be requested either by Affymetrix probeset or Ensembl exon id. (Usually several Affymetrix probes measure an exon. The one chosen as being typical, i.e. most correlated, is indicated with an asterisk *.) Correlations follow the same colour coding as the fixed matrices. Hyperlinks on the matrix lead to the underlying scatter plot. (Remember to press plot.) Additionally the text button displays the averages and correlations in numeric form.

3. RNA SYSTEMS BIOLOGY

We calculated the correlations across all of GEO of 24,132 exons with each other. The main RNAnet graphical screen allows Firefox users to query these 290 million correlation coefficients by gene name or Ensembl exon id. Strong correlations or anti-correlations can be plotted on a PCA analysis of the 290 million correlations. Additionally up to ten exons closest to the dragable crosshairs (cf. sect. 1) can be displayed. Once an exon is selected it should be locked into the display (2nd box on right) to avoid the next search over writing it. Again heat maps are created and displayed as needed. Due to non-unique mappings between Ensembl exons and Affymetrix probesets and concerns about sequence quality, correlations for only 24,132 Ensembl exons are available. They represent about half the Human genes.

To Dec 2009, 3,585 pages had been loaded by people (excluding Essex and King’s). In the last 15 months there have been ≈ 250 downloads per month. RNAnet was publicised at UK Affy 2008 and a poster presented at EMBL 2008. Cf. technical report. RNAnet was used to corroborate experimental results on Mycoplasma contamination.

References

[1] W. B. Langdon. A map of human gene expression. CES-486, University of Essex, UK, July 2008.
[2] E. Aldecoa-Otalora et al. Unexpected presence of Mycoplasma probes on human microarrays. BioTechniques, 47(6), pp1013–1016, December 2009.