main

September 5, 2021

1 Summary of eQTL analysis

```
[1]: import functools
     import pandas as pd
```

```
[2]: config = {
         "genes": "/ceph/projects/v4_phase3_paper/inputs/counts/text_files_counts/_m/
      ↪caudate/gene_annotation.tsv",
         "transcripts": "/ceph/projects/v4_phase3_paper/inputs/counts/
      ↪text_files_counts/_m/caudate/tx_annotation.tsv",
         "exons": "/ceph/projects/v4_phase3_paper/inputs/counts/text_files_counts/_m/
      ↪caudate/exon_annotation.tsv",
         "junctions": "/ceph/projects/v4_phase3_paper/inputs/counts/
      ↪text_files_counts/_m/caudate/jxn_annotation.tsv"
     }
```

1.1 Functions

```
[3]: @functools.lru_cache()
     def get_eqtls(feature):
         fn = "/ceph/projects/v4_phase3_paper/analysis/eqtl_analysis/all/%s/
      ↪expression_gct/" % feature +\
             "prepare_expression/annotate_outputs/_m/Brainseq_LIBD.signifpairs.txt.
      ↪gz"
         return pd.read_csv(fn, sep='\t')


     @functools.lru_cache()
     def annotate_eqtls(feature):
         annot = pd.read_csv(config[feature], sep='\t').loc[:, ["names",␣
      ↪"gencodeID"]]
         return get_eqtls(feature).merge(annot, left_on="gene_id", right_on="names").
      ↪drop(["names"], axis=1)


     @functools.lru_cache()
     def load_pgc2():
```

```
    pgc2_file = '/ceph/projects/v4_phase3_paper/inputs/sz_gwas/'+\
                'pgc2_clozuk/map_phase3/_m/libd_hg38_pgc2sz_snps_p5e_minus8.tsv'
    return pd.read_csv(pgc2_file, sep='\t', low_memory=False)


@functools.lru_cache()
def merge_pgc2_N_eqtl(feature):
    return load_pgc2().merge(annotate_eqtls(feature), how='inner',
                             left_on='our_snp_id', right_on='variant_id',
                             suffixes=['_PGC2', '_eqtl'])
```

1.2 Load data

1.2.1 Load significant eQTLs after permutation analysis

```
[4]: genes = annotate_eqtls("genes")
     trans = annotate_eqtls("transcripts")
     exons = annotate_eqtls("exons")
     juncs = annotate_eqtls("junctions")
```

1.2.2 Load PGC2+CLOZUK annotated eQTLs

```
[5]: genes2 = merge_pgc2_N_eqtl("genes")
     trans2 = merge_pgc2_N_eqtl("transcripts")
     exons2 = merge_pgc2_N_eqtl("exons")
     juncs2 = merge_pgc2_N_eqtl("junctions")
```

1.3 Summarize results eQTL analysis

1.3.1 Total significant gene-variant pairs

```
[6]: gg = genes.shape[0]
     tt = trans.shape[0]
     ee = exons.shape[0]
     jj = juncs.shape[0]

     print("\nGene:\t\t%d\nTranscript:\t%d\nExon:\t\t%d\nJunction:\t%d" %
           (gg, tt, ee, jj))
```

```
Gene:           2242055
Transcript:     3041906
Exon:           4783603
Junction:       5052809
```

1.3.2 Total significant eGenes

```
[7]: gg = len(set(genes['gene_id']))
     tt = len(set(trans['gene_id']))
     ee = len(set(exons['gene_id']))
     jj = len(set(juncs['gene_id']))

     print("\neGene:\t\t%d\neTranscript:\t%d\neExon:\t\t%d\neJunction:\t%d" %
           (gg, tt, ee, jj))
```

```
eGene:          16014
eTranscript:    26092
eExon:          42510
eJunction:      46804
```

1.3.3 Total significant eGenes

```
[8]: gg = len(set(genes['gencodeID']))
     tt = len(set(trans['gencodeID']))
     ee = len(set(exons['gencodeID']))
     jj = len(set(juncs['gencodeID']))

     print("\nGene:\t\t%d\nTranscript:\t%d\nExon:\t\t%d\nJunction:\t%d" %
           (gg, tt, ee, jj))
```

```
Gene:           16014
Transcript:     13700
Exon:           13910
Junction:       10087
```

1.4 Summarize results eQTL analysis overlapping with PGC2+CLOZUK SNPs

1.4.1 Total significant gene-variant pairs

```
[9]: gg = genes2.shape[0]
     tt = trans2.shape[0]
     ee = exons2.shape[0]
     jj = juncs2.shape[0]

     print("\nGene:\t\t%d\nTranscript:\t%d\nExon:\t\t%d\nJunction:\t%d" %
           (gg, tt, ee, jj))
```

```
Gene:           40139
Transcript:     60356
Exon:           75669
Junction:       98419
```

1.4.2 Total significant eGenes

```
[10]: gg = len(set(genes2['gene_id']))
      tt = len(set(trans2['gene_id']))
      ee = len(set(exons2['gene_id']))
      jj = len(set(juncs2['gene_id']))

      print("\neGene:\t\t%d\neTranscript:\t%d\neExon:\t\t%d\neJunction:\t%d" %
            (gg, tt, ee, jj))
```

```
eGene:          382
eTranscript:    576
eExon:          855
eJunction:      937
```

1.4.3 Total significant eFeatures

```
[11]: gg = len(set(genes2['gencodeID']))
      tt = len(set(trans2['gencodeID']))
      ee = len(set(exons2['gencodeID']))
      jj = len(set(juncs2['gencodeID']))

      print("\nGene:\t\t%d\nTranscript:\t%d\nExon:\t\t%d\nJunction:\t%d" %
            (gg, tt, ee, jj))
```

```
Gene:           382
Transcript:     342
Exon:           337
Junction:       255
```

1.5 Save significant results

1.5.1 All associations

```
[12]: genes["Type"] = "Gene"
      trans["Type"] = "Transcript"
      exons["Type"] = "Exon"
      juncs["Type"] = "Junction"

      df = pd.concat([genes, trans, exons, juncs])\
              .loc[:, ["variant_id", "gene_id", "gencodeID", "tss_distance",␣
       ↪"ma_samples", "ma_count",
                       "maf", "slope", "slope_se", "pval_nominal",␣
       ↪"pval_nominal_threshold",
                       "min_pval_nominal", "pval_beta", "Type"]]
      df["Type"] = df.Type.astype("category").cat.reorder_categories(["Gene",␣
       ↪"Transcript", "Exon", "Junction"])
```

```
df.sort_values(["Type", "gene_id", "pval_nominal"])\
    .to_csv("Brainseq_LIBD_caudate_4features.signifpairs.txt.gz", sep='\t',␣
→index=False)
```

1.5.2 PGC2+CLOZUK associated variants

```
[13]: genes2["Type"] = "Gene"
      trans2["Type"] = "Transcript"
      exons2["Type"] = "Exon"
      juncs2["Type"] = "Junction"

      df = pd.concat([genes2, trans2, exons2, juncs2])\
              .loc[:, ["variant_id", "rsid", "hg38chrc", "gene_id", "gencodeID",␣
       →"maf", "Freq.A1", "A1",
                        "A2", "slope", "slope_se", "OR", "SE", "P", "pval_nominal",␣
       →"pval_nominal_threshold",
                        "pgc2_a1_same_as_our_counted", "is_index_snp", "Type"]]
      df["Type"] = df.Type.astype("category").cat.reorder_categories(["Gene",␣
       →"Transcript", "Exon", "Junction"])
      df.sort_values(["Type", "gene_id", "pval_nominal", "P"])\
          .to_csv("Brainseq_LIBD_caudate_4features_PGC2.signifpairs.txt.gz", sep='\t',␣
       →index=False)
```

```
[ ]:
```