Analyzing Large Scale Genomic Data Using the Google Cloud Platform

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460 Human Genomes from MVP Pilot

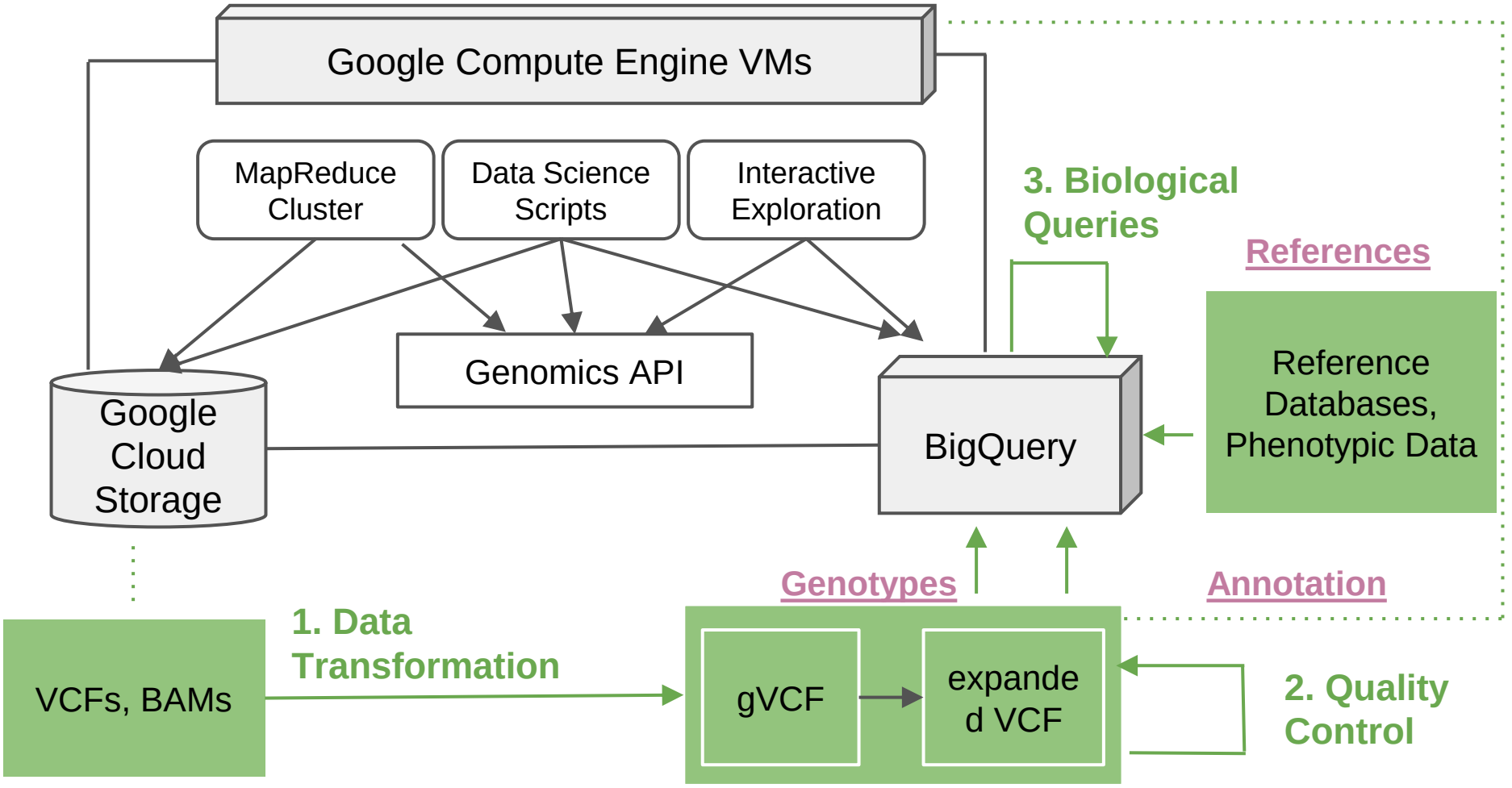
One Genome

- 3 billion DNA base pairs
- 3 million single nucleotide variation
- 50,000 private variants

460 Genomes

- 48T pre-processed data
- 26M single nucleotide variation
- 5M short insertion and deletion

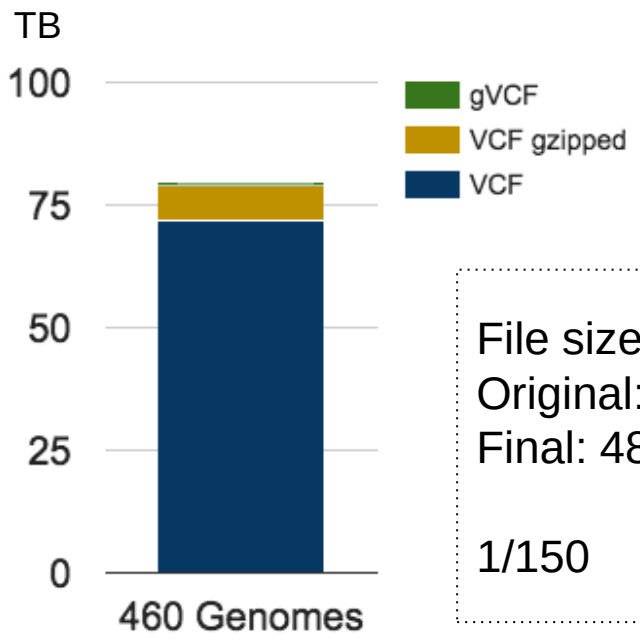
GCP and Our Workflow



Data Transformation and BigQuery Schema

gVCF:

- filter/tag variants by quality
- collapse consecutive REFs

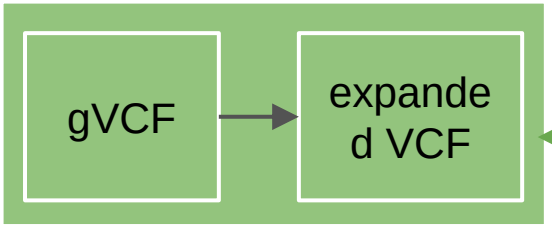


File size:
Original: 72T
Final: 481G

1/150

reference_name	STRING
start	INTEGER
end	INTEGER
reference_bases	STRING
alternate_bases	STRING
call	RECORD
-- call.call_set_id	STRING
-- call.call_set_name	STRING
-- call.genotype	INTEGER
-- call.FILTER	STRING
-- call.QUAL	FLOAT
...	

Multi-level Quality Controls



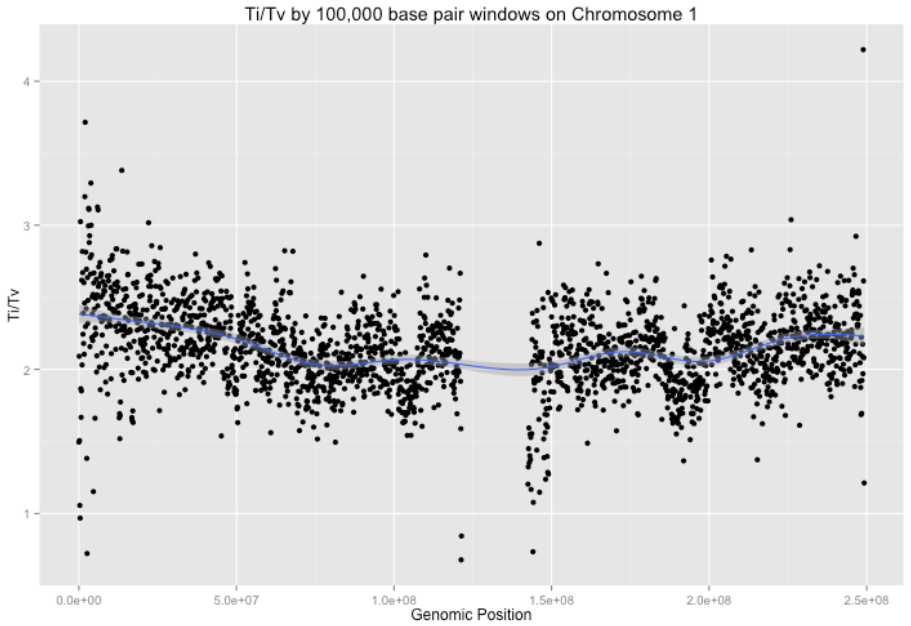
2. Quality Control

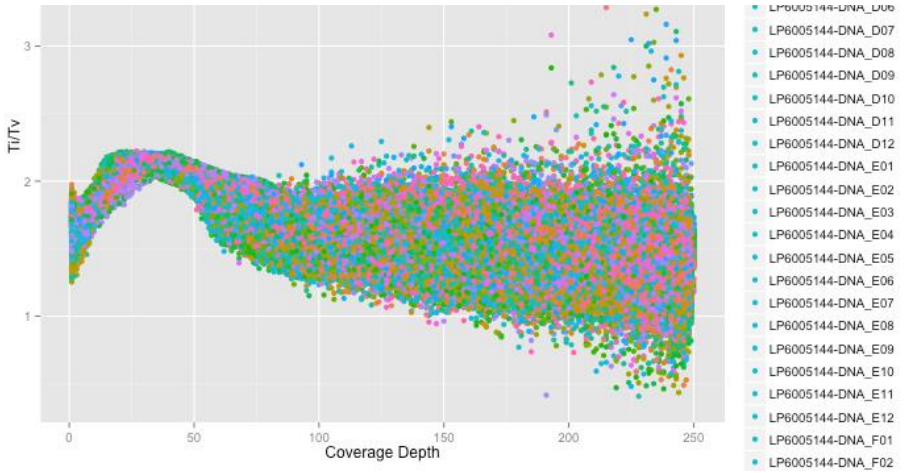
Sample Level QC

1. batch effect
2. concordance to SNP array data
3. sex inference
4. ethnicity inference
5. genome similarity: IBS
6. missingness rate
7. singleton rate
8. heterozygosity rate
9. inbreeding coefficient

Variant Level QC

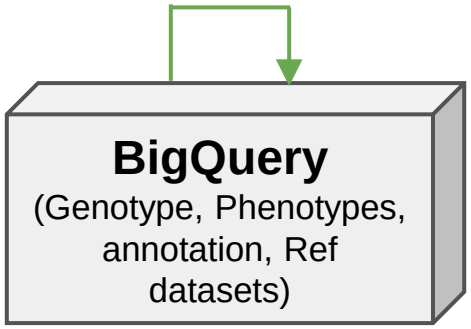
1. remove variants on blacklisted genes
2. heterozygous haplotype
3. missingness rate
4. Hardy-Weinberg Equilibrium
5. Ti/Tv by depth
6. Ti/Tv by alternate allele counts



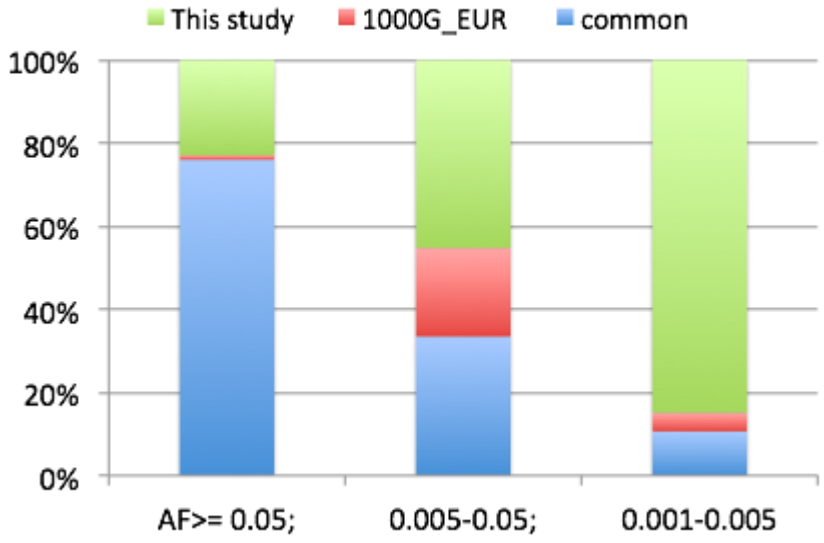


Biological Queries

3. Biological Queries



- Querying Genotypes
- Querying Biological Features
- Querying Medical Information

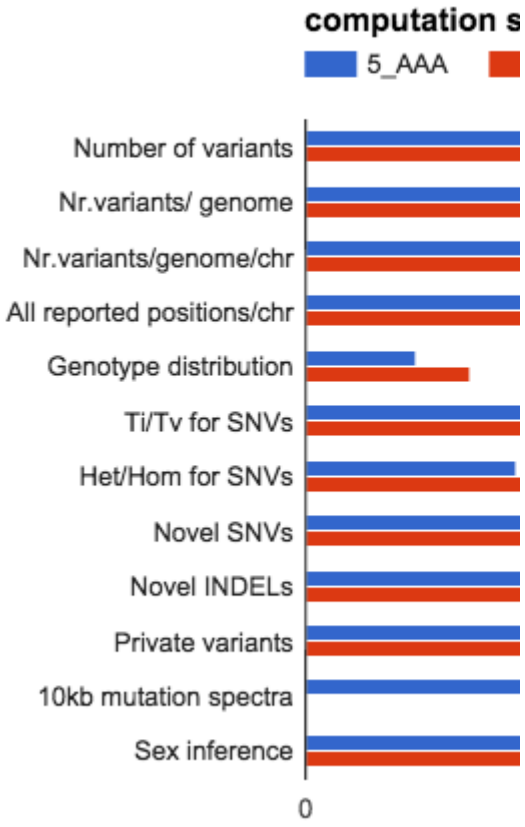


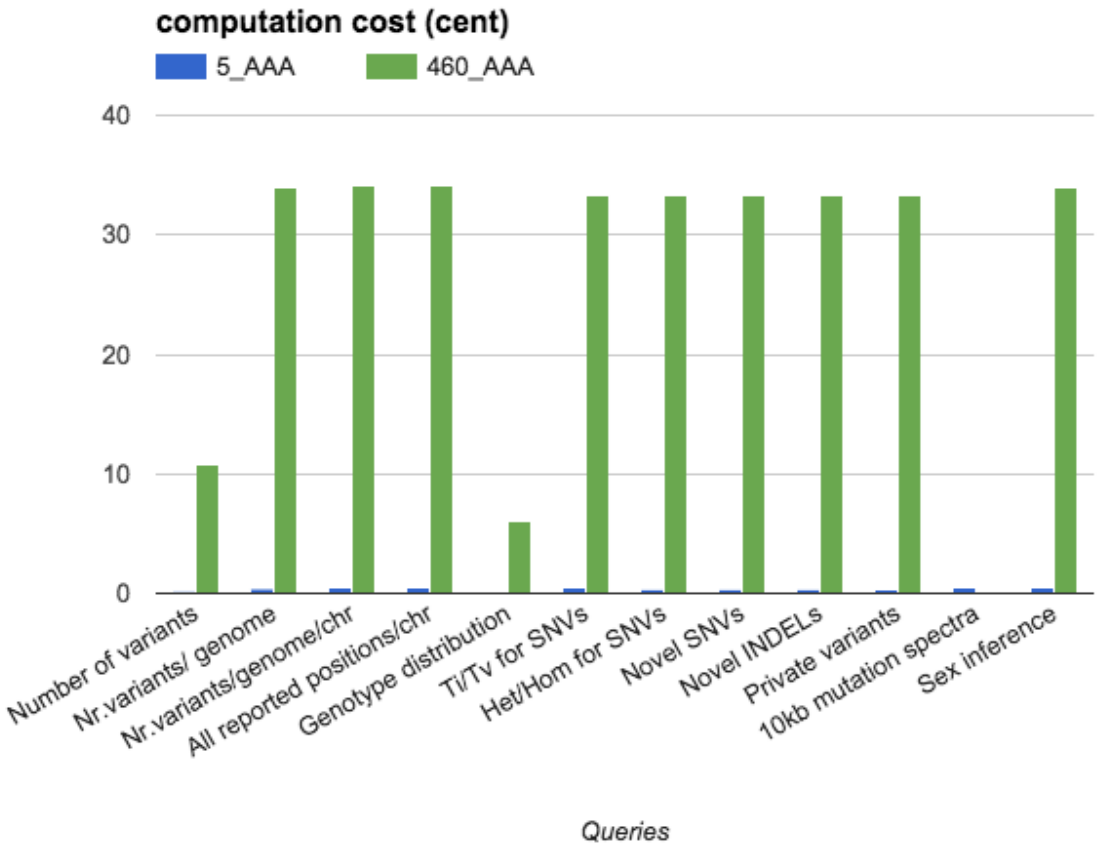
VKORC1 Genotype (-1639G>A, rs9923231)	*CYP2C9*1/*1*	*CYP2C9*1/*2*	*CYP2C9*1/*3*	*CYP2C9*2/*2*	*CYP2C9*2/*3*	*CYP2C9*3/*3*
GG	5-7	5-7	3-4	3-4	3-4	0.5-2
GA	5-7	3-4	3-4	3-4	0.5-2	0.5-2
AA	3-4	3-4	0.5-2	0.5-2	0.5-2	0.5-2

PharmGKB
Pharmacogenomics. Knowledge. Implementation.

5-7 mg/day: 288 subjects; 3-4 mg/day: 150 subject; 0.5-2 mg/day: 21 subjects

Scalability and Affordability of GCP





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