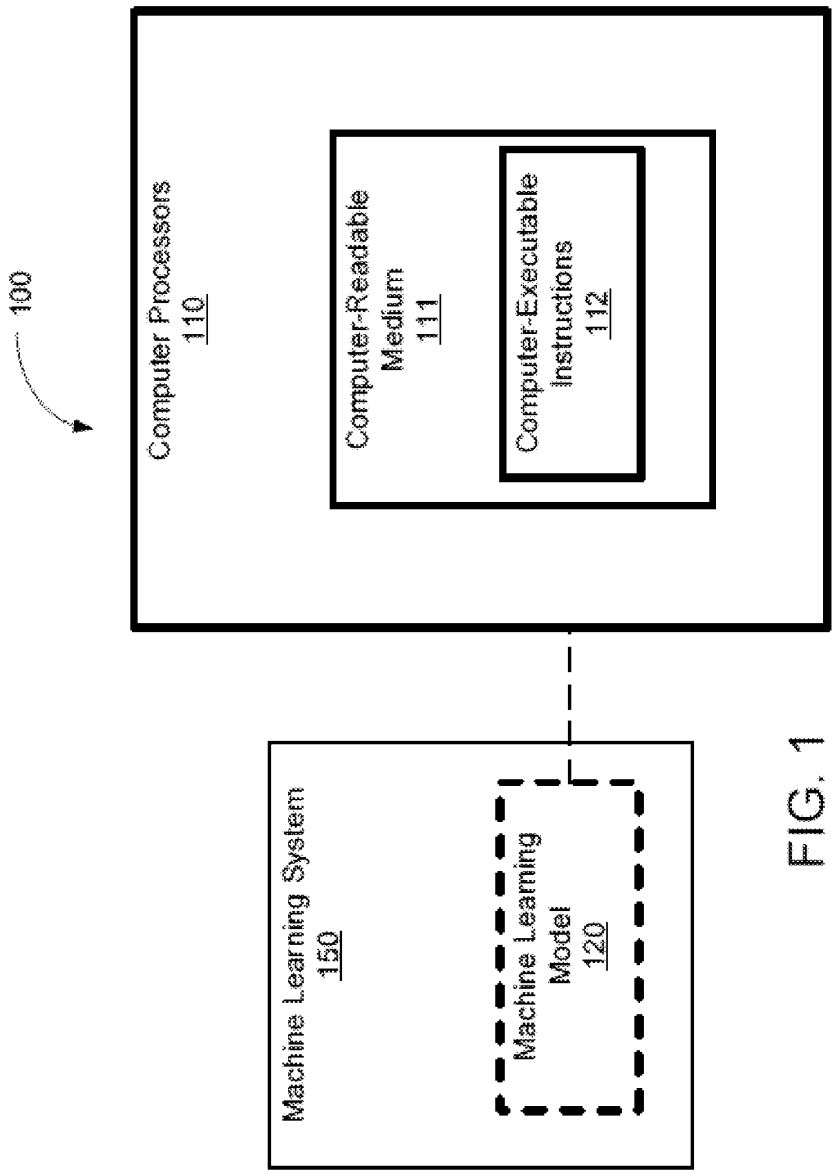

100
Computer Processors
110
Computer-Readable
Medium
111
Computer-Executable
instructions
112
Machine Learning System
150
Machine Learning
Model
120

FIG. 1

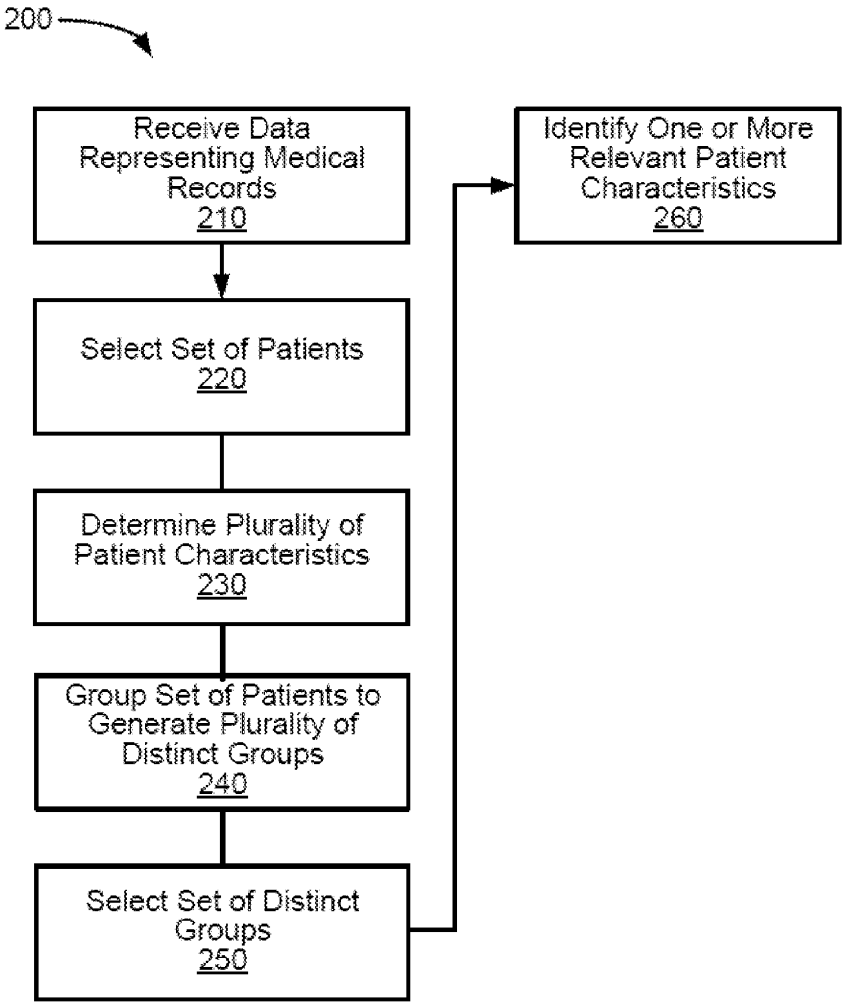

200
Receive Data Representing Medical Records 210
Select Set of Patients 220
Determine Plurality of Patient Characteristics 230
Group Set of Patients to Generate Plurality of Distinct Groups 240
Select Set of Distinct Groups 250
Identify One or More Relevant Patient Characteristics 260

FIG. 2

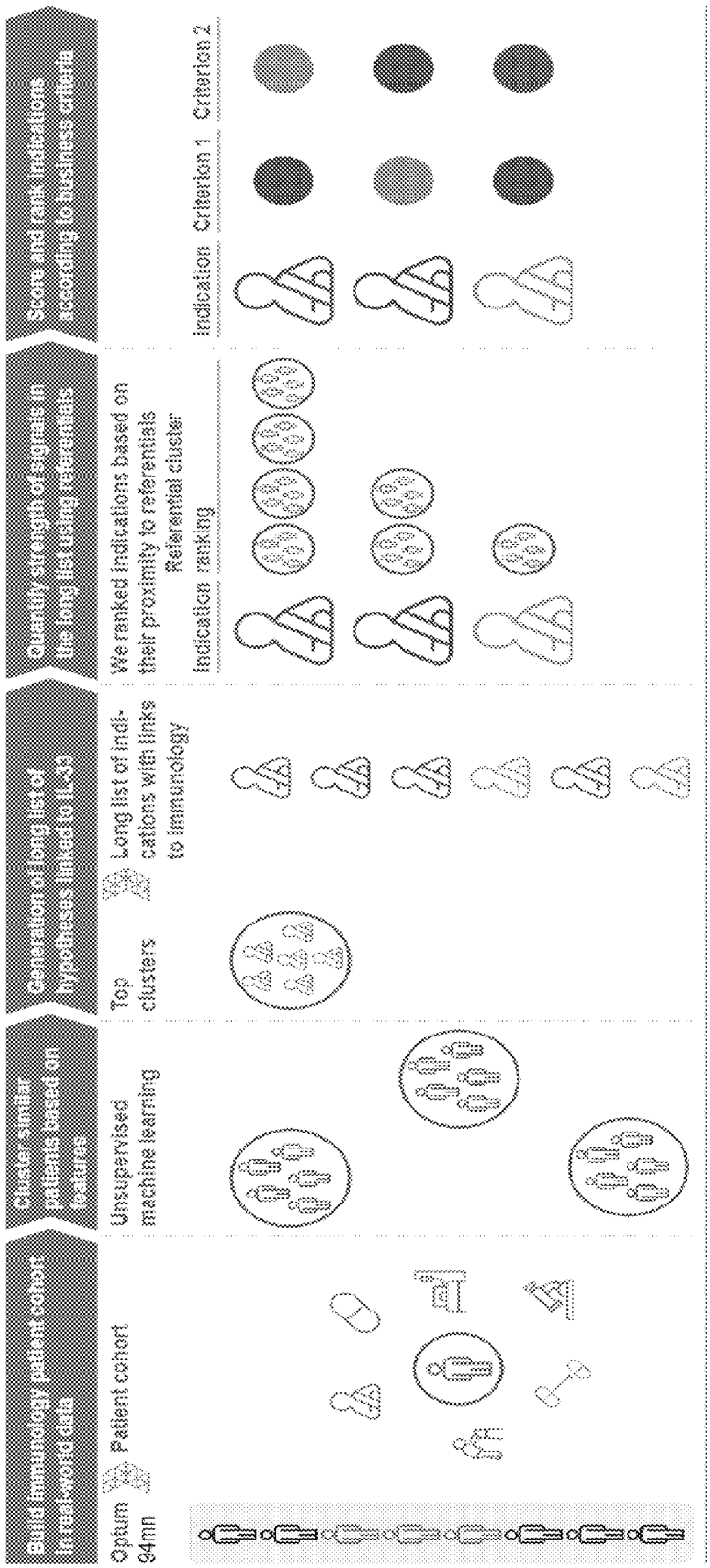
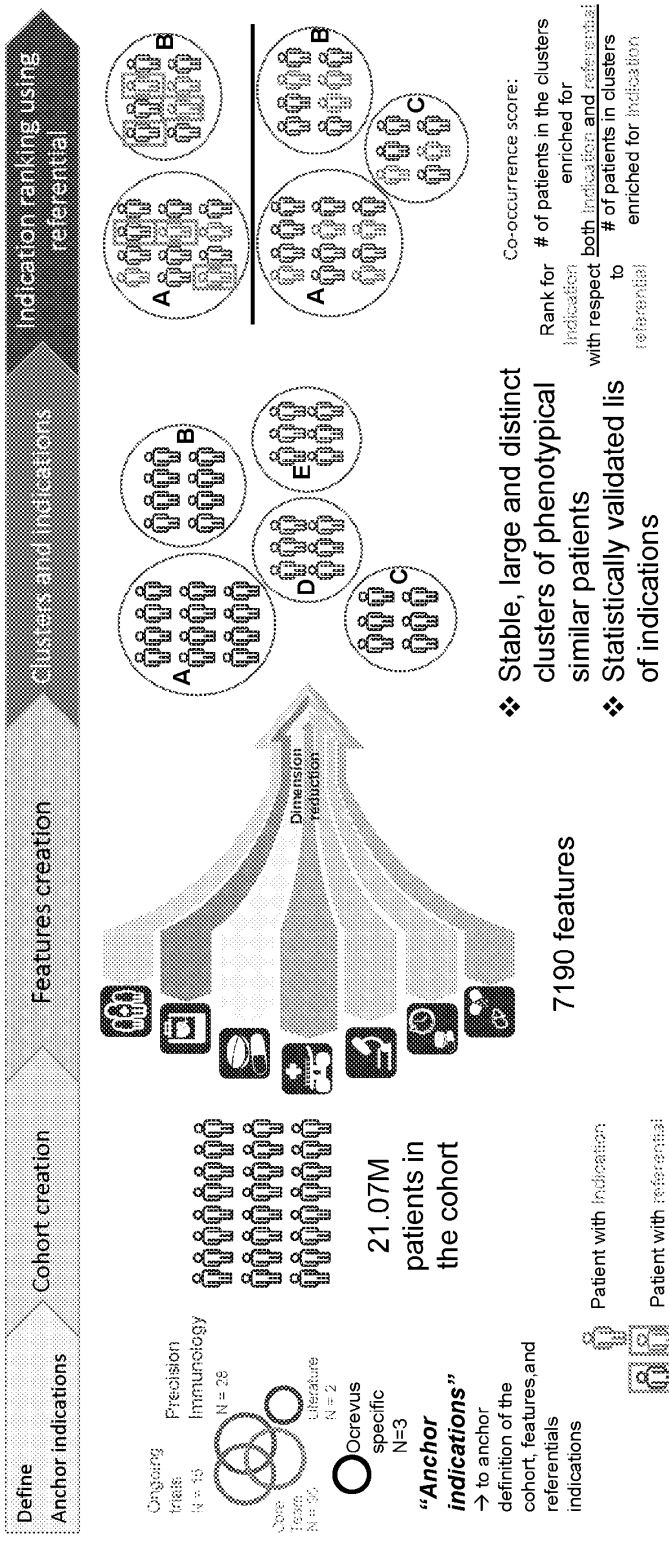

Build immunology patient cohort in real-world data
Optum 94mn
Patient cohort
Cluster similar patients based on features
Unsupervised machine learning
Generation of long list of hypotheses linked to IL-33
Top clusters
Long list of indications with links to immunology
Quantify strength of signals in the long list using referentials
We ranked indications based on their proximity to referentials
Referential cluster
Indication
ranking
Score and rank indications according to business criteria
Indication
Criterion 1
Criterion 2

FIG. 3

FIG. 4


Define
Anchor indications
Cohort creation
Features creation
Clusters and indications
Indication ranking using referential
Ongoing trials N = 13
Precision Immunology N = 28
Literature N = 2
Ocrevus specific N=3
"Anchor indications"
→ to anchor definition of the cohort, features,and referentials indications
21.07M patients in the cohort
Dimension reduction
7190 features
Patient with indication
Patient with referential
A
B
C
D
E
❖ Stable, large and distinct clusters of phenotypical similar patients
❖ Statistically validated lis of indications
Co-occurrence score:
Rank for indication with respect to referential
# of patients in the clusters enriched for both Indication and referential
# of patients in clusters enriched for Indication

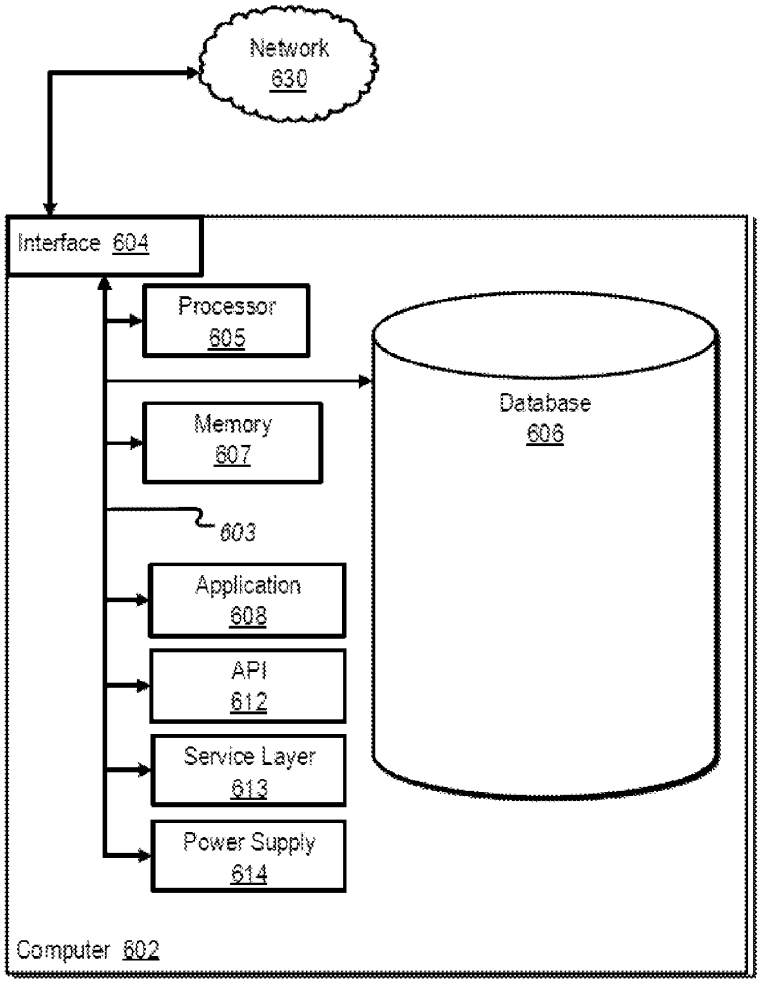
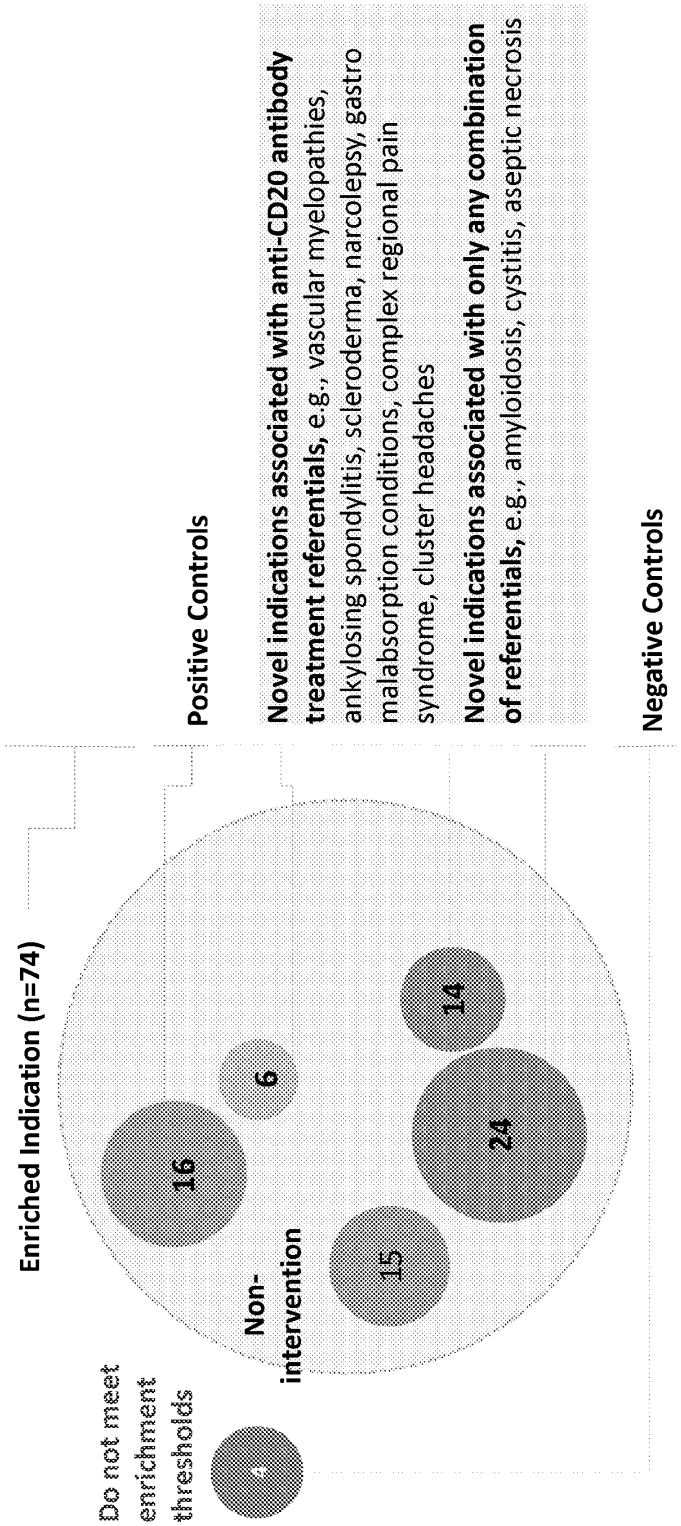

Network
630
Interface 604
Processor
605
Memory
607
603
Application
608
API
612
Service Layer
613
Power Supply
614
Database
606
Computer 602

FIG. 5

FIG. 6


Enriched Indication (n=74)
Positive Controls
Novel indications associated with anti-CD20 antibody treatment referentials, e.g., vascular myelopathies, ankylosing spondylitis, scleroderma, narcolepsy, gastro malabsorption conditions, complex regional pain syndrome, cluster headaches
Novel indications associated with only any combination of referentials, e.g., amyloidosis, cystitis, aseptic necrosis
Negative Controls
Non-intervention
16
6
15
14
24
Do not meet enrichment thresholds
1