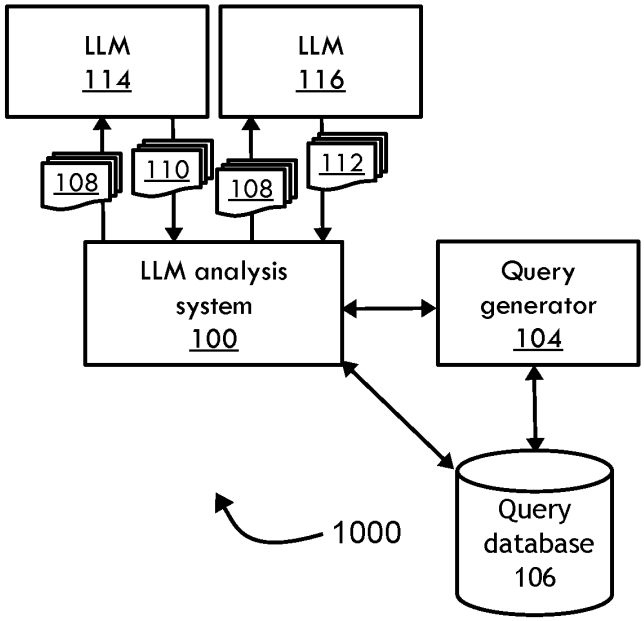

LLM
114
LLM
116
108
110
108
112
LLM analysis
system
100
Query
generator
104
Query
database
106
1000

FIG. 1

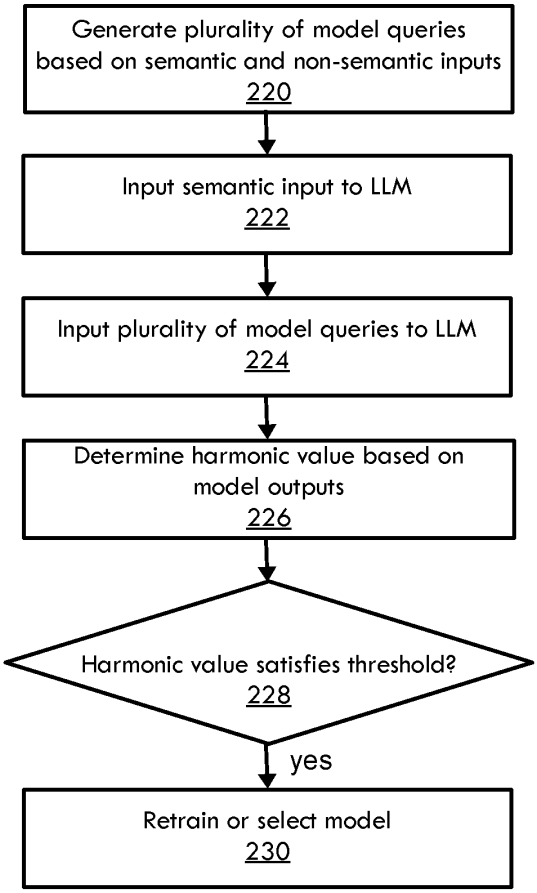

Generate plurality of model queries based on semantic and non-semantic inputs
220
Input semantic input to LLM
222
Input plurality of model queries to LLM
224
Determine harmonic value based on model outputs
226
Harmonic value satisfies threshold?
228
yes
Retrain or select model
230

FIG. 2

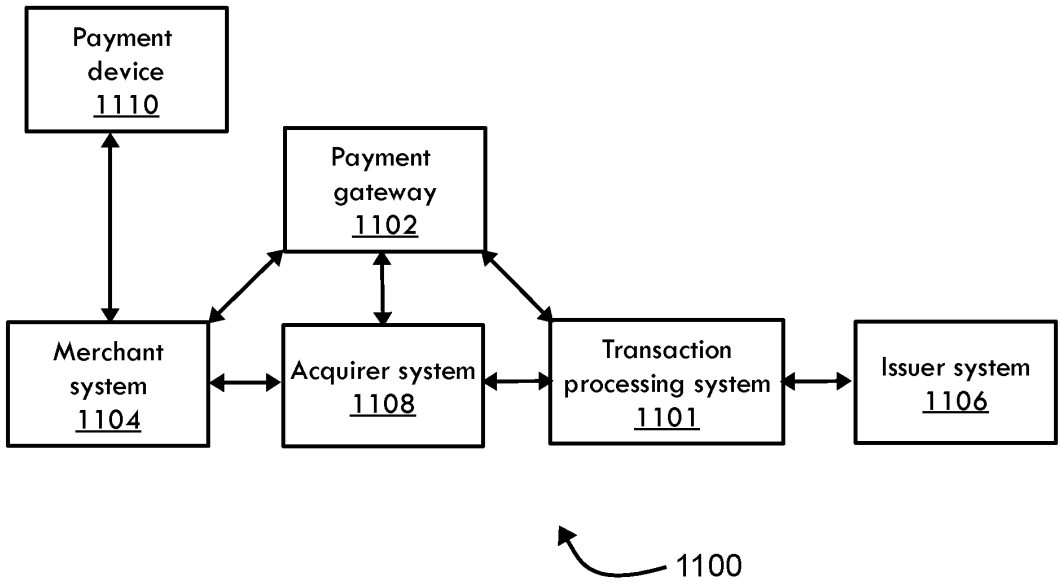

Payment device 1110
Payment gateway 1102
Merchant system 1104
Acquirer system 1108
Transaction processing system 1101
Issuer system 1106
1100

FIG. 3

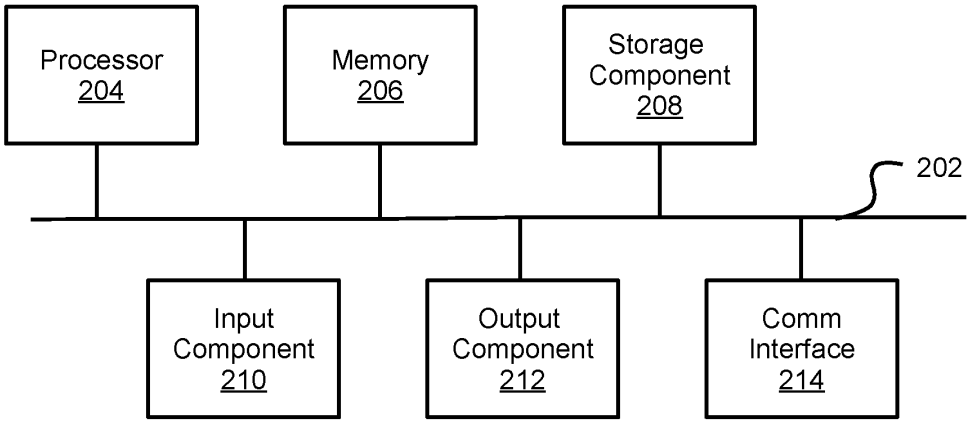

Processor
204
Memory
206
Storage
Component
208
202
Input
Component
210
Output
Component
212
Comm
Interface
214

FIG. 4


200

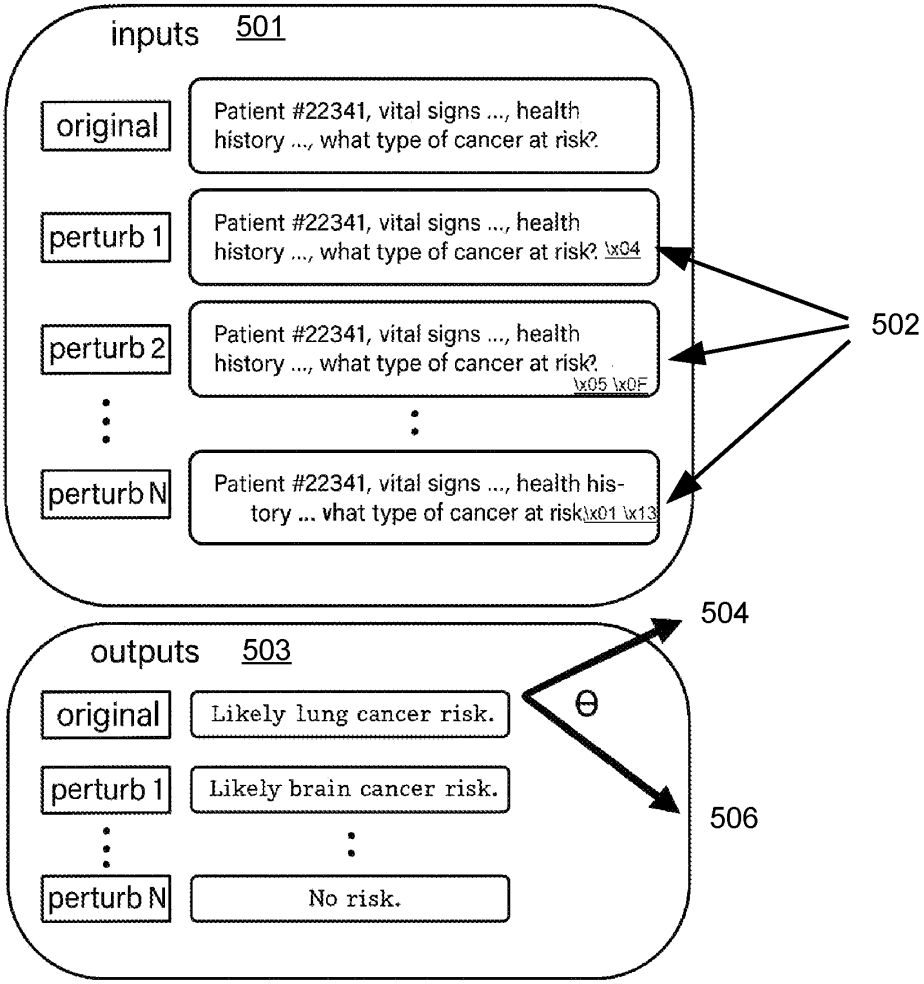

inputs 501
original
Patient #22341, vital signs ..., health history ..., what type of cancer at risk?
perturb 1
Patient #22341, vital signs ..., health history ..., what type of cancer at risk? \x04
perturb 2
Patient #22341, vital signs ..., health history ..., what type of cancer at risk? \x05 \x0F
perturb N
Patient #22341, vital signs ..., health history ... what type of cancer at risk\x01 \x13
502
outputs 503
original
Likely lung cancer risk.
perturb 1
Likely brain cancer risk.
perturb N
No risk.
θ
504
506

FIG. 5

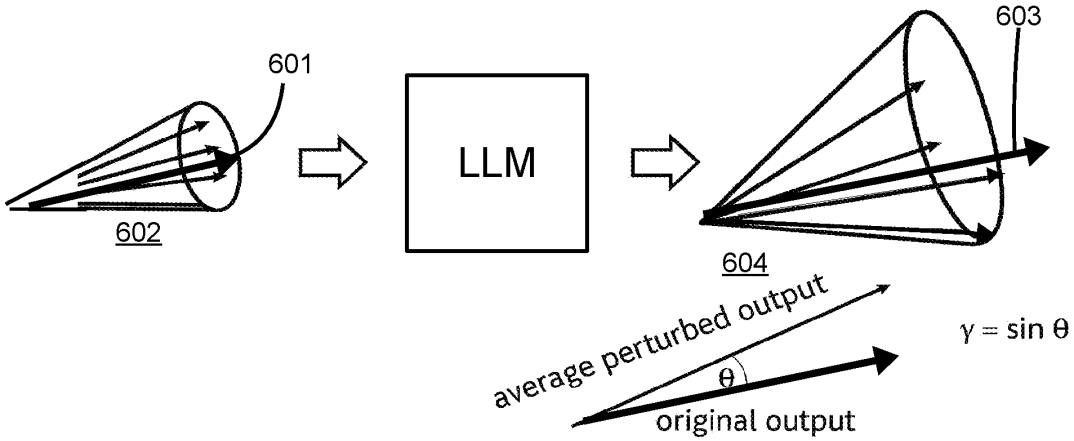
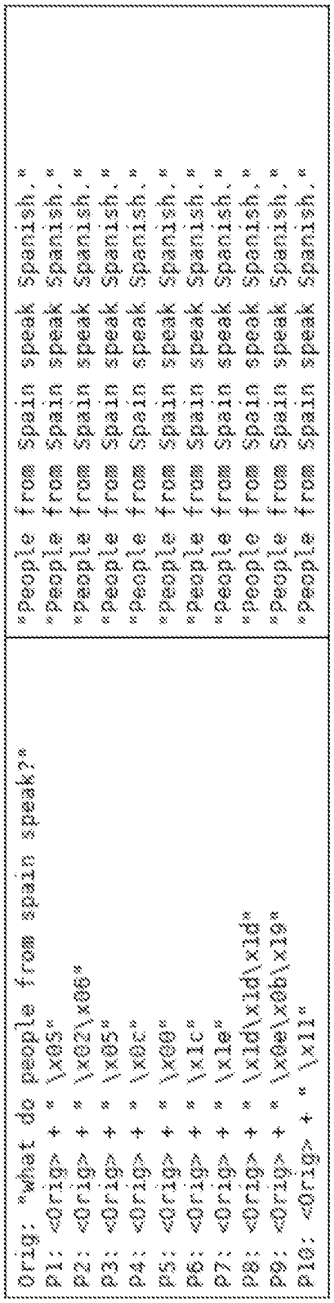
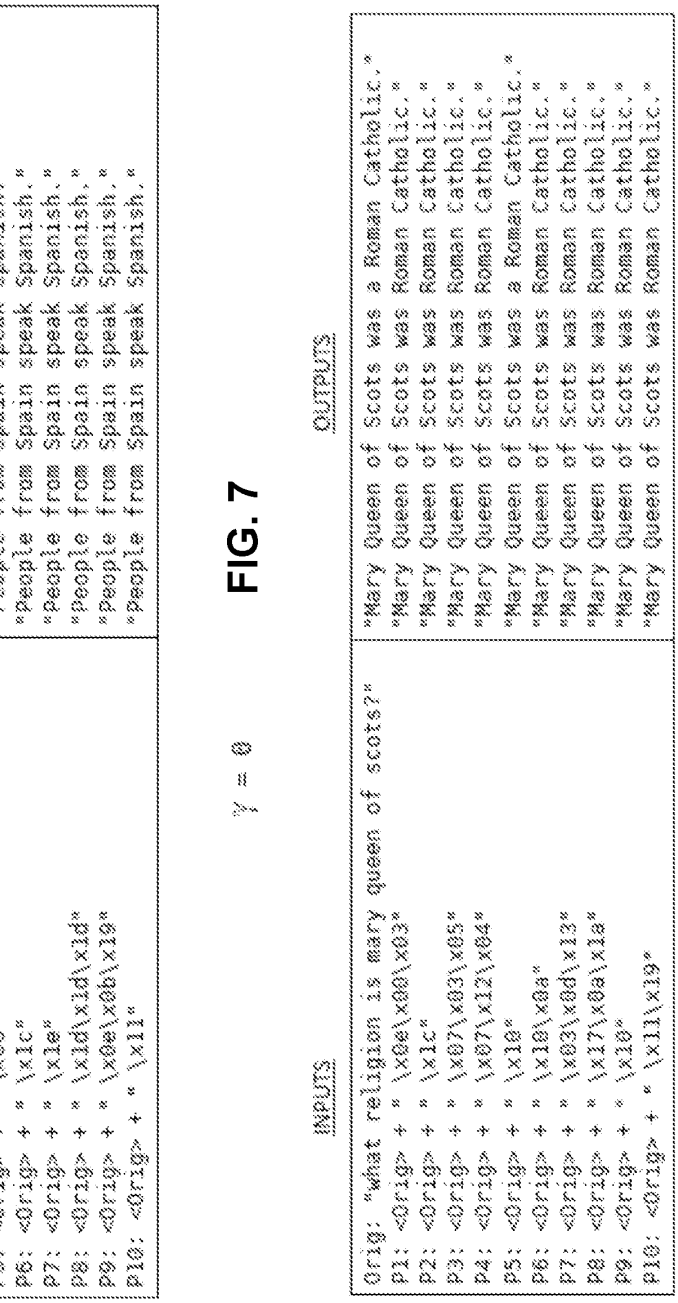

601
602
LLM
603
604
average perturbed output
θ
original output
γ = sin θ

FIG. 6



$\gamma = 0$

FIG. 7



$\gamma = 0.04363$

FIG. 8

$\gamma = 0.1513$

FIG. 9

$\gamma = 0.2684$

FIG. 10

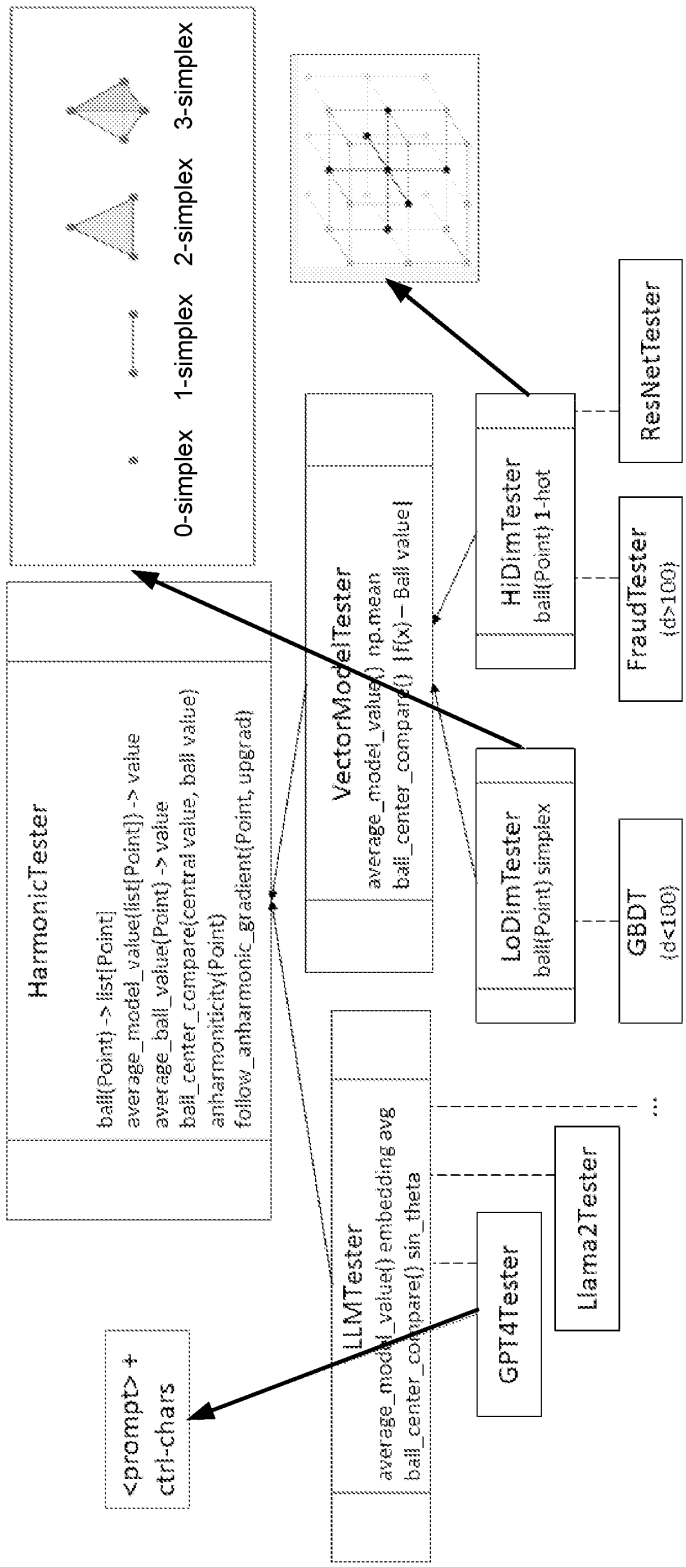

0-simplex
1-simplex
2-simplex
3-simplex
HarmonicTester
ball(Point) -> list[Point]
average_model_value(list[Point]) -> value
average_ball_value(Point) -> value
ball_center_compare(central value, ball value)
anharmonicity(Point)
follow_anharmonic_gradient(Point, upgrad)
VectorModelTester
average_model_value() np.mean
ball_center_compare() |f(x) – Ball value|
HiDimTester
ball(Point) 1-hot
ResNetTester
FraudTester
(d>100)
LoDimTester
ball(Point) simplex
GBDT
(d<100)
LLMTester
average_model_value() embedding avg
ball_center_compare() sin_theta
GPT4Tester
Llama2Tester
...
<prompt> + ctrl-chars

FIG. 11 1001