ML in PostgreSQL

Installation

- git clone https://github.com/akalend/pg_ml.git
- export PG_HOME=/usr/local/pgsql //where is main postgres folder
- wget https://github.com/catboost/catboost/releases/download/v1.2.2/libcatboostmodel.so
- mv libcatboostmodel.so $PG_HOME/lib
- cd pg_ml
- export PG_CONFIG=$PG_HOME/bin/pg_config
- export LD_LIBRARY_PATH=$PG_HOME/lib
- USE_PGXS=1 make
- sudo su
- export PATH=$PATH:$PG_HOME/bin
- USE_PGXS=1 make install
- chown postgres model.cbm
- [optional] cp model.cbm $PG_HOME/data

DataFrame colums as Postgres fields

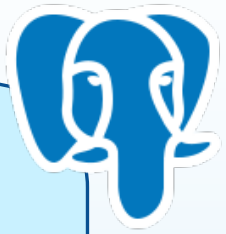
ID, Id, id

FieldID, Field_ID

Import-port

Port, PORT

<=>



id

field_id

import_port

port

DataFrame colums and Postgres fields

```
[14] df = pd.read_csv('star_classification.csv')
```

```
[16] for it in df.columns:
       print(it)
```

```
obj_ID
alpha
delta
u
g
r
i
z
run_ID
rerun_ID
cam_col
field_ID
spec_obj_ID
class
redshift
plate
MJD
fiber_ID
```

<=>

```
adult=# \d astra3
                    Table "public.astra3"
   Column    |        Type        | Collation
-------------+--------------------+-----------
 alpha       | double precision   |
 delta       | double precision   |
 u           | double precision   |
 g           | double precision   |
 r           | double precision   |
 i           | double precision   |
 z           | double precision   |
 run_id      | bigint             |
 cam_col     | bigint             |
 field_id    | bigint             |
 spec_obj_id | double precision   |
 redshift    | double precision   |
 plate       | bigint             |
 mjd         | bigint             |
 fiber_id    | bigint             |

adult=#
```

DataFrame colums and Postgres fields

```
df.head()
```

	obj_ID	alpha	delta	u	g	r	i	z	run_ID	rerun_ID	cam_col	field_ID	spec_obj_ID
0	1.237661e+18	135.689107	32.494632	23.87882	22.27530	20.39501	19.16573	18.79371	3606	301	2	79	6.543777e+18
1	1.237665e+18	144.826101	31.274185	24.77759	22.83188	22.58444	21.16812	21.61427	4518	301	5	119	1.176014e+19
2	1.237661e+18	142.188790	35.582444	25.26307	22.66389	20.60976	19.34857	18.94827	3606	301	2	120	5.152200e+18
3	1.237663e+18	338.741038	-0.402828	22.13682	23.77656	21.61162	20.50454	19.25010	4192	301	3	214	1.030107e+19
4	1.237680e+18	345.282593	21.183866	19.43718	17.58028	16.49747	15.97711	15.54461	8102	301	3	137	6.891865e+18

```
adult=#  select * from astra3 limit 3;
      alpha       |      delta       |    u     |    g     |    r     |    i     |    z     | run_id | cam_col | field_id |      spec_obj_id       |
------------------+------------------+----------+----------+----------+----------+----------+--------+---------+----------+------------------------+
 16.9568897845004 | 3.64613008870454 | 23.33542 | 21.95143 | 20.48149 |   19.603 | 19.13094 |   7712 |       6 |      442 | 4.855016555329904e+18  |
 240.063240247767 | 6.13413059813973 | 17.86033 | 16.79228 | 16.43001 | 16.30923 | 16.25873 |   3894 |       1 |      243 | 2.4489280322708705e+18 |
  30.887222067625 | 1.18870964120799 | 18.18911 | 16.89469 | 16.42161 | 16.24627 | 16.18549 |   7717 |       1 |      536 | 8.255357438959835e+18  |
(3 rows)
```

Model information

```
adult=# SELECT ml_info ('astra3.cbm');
                                        ml_info
-------------------------------------------------------------------------------
 dimension:3 numeric features:12 categorial features:0 modelType "MultiClass"+
 fieldName:alpha,delta,u,g,r,i,z,cam_col,redshift,plate,MJD,fiber_ID
(1 row)

adult=#
```

```
adult=# SELECT ml_info ('titanic.cbm');
                                          ml_info
-------------------------------------------------------------------------------------
 dimension:1 numeric features:2 categorial features:9 modelType "Accuracy"          +
 fieldName:PassengerId,Pclass,Name,Sex,Age,SibSp,Parch,Ticket,Fare,Cabin,Embarked
(1 row)
```

Prediction of model

```
adult=# SELECT ml_predict ('astra3.cbm','astra3');
WARNING:  field run_id not used
WARNING:  field field_id not used
WARNING:  field spec_obj_id not used
WARNING:  field predict not used
      ml_predict
-----------------------
 public.astra3_predict
(1 row)
```

Create
the new table

Prediction results

```
adult=# SELECT * from astra3_predict;
 row |       alpha       |       delta       |    u     |    g     |    r     |    i     |    z     | run_id | cam_col | field_id |      spec_obj_id      |   redshift    | plate |  mjd  | fiber_id | predict |  class
-----+-------------------+-------------------+----------+----------+----------+----------+----------+--------+---------+----------+-----------------------+---------------+-------+-------+----------+---------+--------
   1 |  16.9568897845004 |  3.64613008870454 | 23.33542 | 21.95143 | 20.48149 |   19.603 | 19.13094 |   7712 |       6 |      442 | 4.855016555329904e+18 |  0.5062369    |  4312 | 55511 |      495 | 0.98686 | GALAXY
   2 |  240.063240247767 |  6.13413059813973 | 17.86033 | 16.79228 | 16.43001 | 16.30923 | 16.25873 |   3894 |       1 |      243 | 2.448928032270870e+18 | 0.0003448142  |  2175 | 54612 |      348 | 0.990419 | STAR
   3 |   30.887222067625 |  1.18870964120799 | 18.18911 | 16.89469 | 16.42161 | 16.24627 | 16.18549 |   7717 |       1 |      536 | 8.255357438959835e+18 | 4.085216e-06  |  7332 | 56683 |      943 | 0.997588 | STAR
   4 |  247.594400505002 |  10.8877797153666 | 24.99961 | 21.71203 | 21.47148 | 21.30532 | 21.29109 |   5323 |       1 |      134 | 4.577998722756271e+18 | -0.0002914838 |  4066 | 55444 |      326 | 0.997667 | STAR
   5 |  18.8964507920807 | -5.26133022886992 | 23.76648 | 21.79737 | 20.69543 | 20.23403 | 19.97464 |   7881 |       3 |      148 | 8.91047176642785e+18  | -0.0001361561 |  7914 | 57331 |      363 | 0.996044 | STAR
   6 |  182.713733094955 |  51.3758050594777 | 22.44608 | 21.68444 | 20.24292 | 19.41423 | 19.08227 |   2830 |       1 |      411 | 7.516725588574623e+18 |  0.5026683    |  6676 | 56389 |      752 | 0.984373 | GALAXY
   7 |  150.089423193165 |  39.4670880748061 | 18.96441 | 17.82906 | 17.31429 | 16.99891 | 16.85583 |   3560 |       4 |      278 | 1.526795641110423e+18 |  0.06366445   |  1356 | 53033 |      274 | 0.996164 | GALAXY
   8 |  189.510984338851 |  58.7411197772507 | 21.37376 | 20.80187 | 20.84925 | 21.13449 | 20.34689 |   2243 |       1 |      353 | 7.696817897528907e+18 |  0.7936153    |  6836 | 56443 |      604 | 0.957787 | QSO
   9 |  37.7138728560977 | -0.52513822814650 | 20.77988 | 19.54618 | 19.16687 | 18.89438 | 18.64286 |   2700 |       2 |      117 | 1.755328312302921e+18 |  0.1060118    |  1559 | 53271 |      183 | 0.993892 | GALAXY
  10 |  201.074980072746 |  28.7699058867715 | 25.05349 | 22.23362 |  20.8122 | 19.69488 | 19.28336 |   4649 |       3 |      120 | 7.306035245308205e+18 |  0.567082     |  6489 | 56329 |      257 | 0.993856 | GALAXY
  11 |  151.8309183267 |  19.8108624669417 | 24.04443 | 22.48608 | 20.59701 | 19.50985 | 19.00457 |   5183 |       5 |      142 | 6.622787444780849e+18 |  0.5475619    |  5882 | 56029 |      808 | 0.998885 | GALAXY
```

Prediction

Multi classification

```
adult=# SELECT * from astra3_predict;
```

row	alpha	delta	u	g	r	i	z	run_id	cam_col	field_id	spec_obj_id	redshift	plate	mjd	fiber_id	predict	class
1	16.9568897845004	3.64613008870454	23.33542	21.95143	20.48149	19.603	19.13094	7712	6	442	4.855016555329904e+18	0.5062369	4312	55511	495	0.98686	GALAXY
2	240.063240247767	6.13413059813973	17.86033	16.79228	16.43001	16.30923	16.25873	3894	1	243	2.448928032270870 5e+18	0.0003448142	2175	54612	348	0.990419	STAR
3	30.88722067625	1.18870964120799	18.18911	16.89469	16.42161	16.24627	16.18549	7717	1	536	8.255357438959835e+18	4.085216e-06	7332	56683	943	0.997588	STAR
4	247.594400505002	10.8877797153666	24.99961	21.71203	21.47148	21.30532	21.29109	5323	1	134	4.577998722756271e+18	-0.0002914838	4066	55444	326	0.997667	STAR
5	18.8964507920807	-5.26133022886992	23.76648	21.79737	20.69543	20.23403	19.97464	7881	3	148	8.9104717664278 5e+18	-0.0001361561	7914	57331	363	0.996044	STAR
6	182.713733094955	51.3758050594777	22.44608	21.68444	20.24292	19.41423	19.08227	2830	1	411	7.516725588574623e+18	0.5026683	6676	56389	792	0.984373	GALAXY
7	150.089423193165	39.4670880748061	18.96441	17.82906	17.31429	16.99891	16.85583	3560	4	278	1.526795641110423 6e+18	0.06366445	1356	53033	274	0.996164	GALAXY
8	189.510984338851	58.7411197772507	21.37376	20.80187	20.84925	21.13449	20.34689	2243	1	353	7.696817897528907e+18	0.7936153	6836	56443	604	0.957787	QSO
9	37.7138728560977	-0.525138228146508	20.77988	19.54618	19.16687	18.89438	18.64286	2700	2	117	1.755328312302921 7e+18	0.1060118	1559	53271	183	0.993892	GALAXY
10	201.074980072746	28.7699058867715	25.05349	22.23362	20.8122	19.69488	19.28336	4649	3	120	7.306035245308205e+18	0.567082	6489	56329	257	0.993856	GALAXY
11	151.8309183267 2	19.8108624669417	24.04443	22.48608	20.59701	19.50985	19.00457	5183	5	142	6.622787444780849e+18	0.5475619	5882	56029	888	0.998885	GALAXY

Binary classification

```
adult=# select * from titanic_predict;
```

row	id	passenger_id	pclass	name	sex	age	sibsp	parch	ticket	fare	cabin	embarked	res	predict
335	334	1226	3	Cor, Mr. Ivan	male	27	0	0	349229	7.8958	-999	S	f	0.115471
1	0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	-999	Q	f	0.142616
2	1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47	1	0	363272	7	-999	S	f	0.310916
3	2	894	2	Myles, Mr. Thomas Francis	male	62	0	0	240276	9.6875	-999	Q	f	0.083718
4	3	895	3	Wirz, Mr. Albert	male	27	0	0	315154	8.6625	-999	S	f	0.125321
5	4	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22	1	1	3101298	12.2875	-999	S	f	0.39712
6	5	897	3	Svensson, Mr. Johan Cervin	male	14	0	0	7538	9.225	-999	S	f	0.112956
7	6	898	3	Connolly, Miss. Kate	female	30	0	0	330972	7.6292	-999	Q	t	0.643697
8	7	899	2	Caldwell, Mr. Albert Francis	male	26	1	1	248738	29	-999	S	f	0.253761
9	8	900	3	Abrahim, Mrs. Joseph (Sophie Halaut Easu)	female	18	0	0	2657	7.2292	-999	C	t	0.662787
10	9	901	3	Davies, Mr. John Samuel	male	21	2	0	A/4 48871	24.15	-999	S	f	0.037293
11	10	902	3	Ilieff, Mr. Ylio	male	-999	0	0	349220	7.8958	-999	S	f	0.093238
12	11	903	1	Jones, Mr. Charles Cresson	male	46	0	0	694	26	-999	S	f	0.210338