



SONY
®



PREDICT FUTURE SALES

MGT 4187 Managerial Analytics

Group 4

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INTRODUCTION

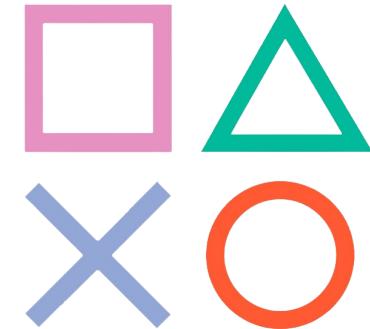
INTRODUCTION

ABOUT SONY GROUP CORP.

- Japanese multinational companies
- Established in 1946
- Manufacturers of world audio-visual, electronic games, communication product

ABOUT PLAYSTATION

- PlayStation series of game consoles produced by SONY
- PS2、PSP、PS3、PSV、PS4、PS5
- **46%** of the world's game console market share
- Over **65%** of game sales are on the PlayStation 4 platform





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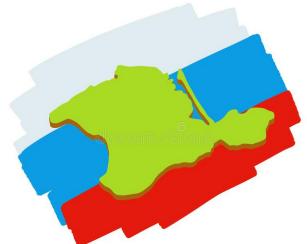
MARKETING PROBLEM

MARKETING PROBLEM

IN 2022



IN 2014



CRIMEAN PENINSULA

HOW SHOULD PLAYSTATION BE
DEPLOYED IN THE POST-WAR RUSSIAN
MARKET?



Predict Future Sales

Final project for "How to win a data science competition" Coursera...

kaggle.com

Sales data from 59

stores of playstation in
Russia from 2013 to 2015

- 1.LINEAR REGRESSION
- 2.MOVING AVERAGE
- 3.LSTM

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**LINEAR
REGRESSION**

FORECASTING WITH LINEAR REGRESSION

ID	shop_id	item_id
1	0	5
2	1	5
3	2	5
4	3	5
5	4	5
6	5	5
7	6	5
8	7	5
9	8	5
10	9	5
11	10	5
12	11	5
13	12	5
14	13	5

Test Dataset

shop_id	item_id	item_price	item_cnt_day
25	5652	2490.0000	1
24	13071	499.0000	2
24	13071	499.0000	2
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	2
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	2
25	13071	499.0000	1
25	13071	499.0000	1
25	13071	499.0000	3
25	13071	499.0000	2

Train Dataset

item_name	item_id	item_category_id
/ОДНАЖДЫ В КИТАЕ-2	20	40
/ПОСЛЕДНИЙ ШАНС	21	40
/ПРОКЛЯТЬЕ ЭЛЬ ЧАРРО	22	40
/СЕВЕР И ЮГ /Ч.2/	23	40
/СМЕРТЕЛЬНЫЙ РАСКЛАД	24	40
/ТЫ - ТРУП	25	40
/УМНОЖАЮЩИЙ ПЕЧАЛЬ т.2 (сер.3-4)	26	40
007 Legends [PS3, русская версия]	27	19
007 Legends [PC, Jewel, русская версия]	28	30
007 Legends [Xbox 360, русская версия]	29	23
007: КООРДИНАТЫ «СКАЙФОЛЛ»	30	40
007: КООРДИНАТЫ «СКАЙФОЛЛ» (BD)	31	37

Item Information

$$\text{ITEM_CNT_DAY} = C + \beta \text{SHOP_ID} + \gamma \text{ITEM_CATEGORY_ID} + \epsilon_T, \epsilon \sim i.i.d. N(0, \Sigma \epsilon^2)$$

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MODEL ACCURACY

```
Residual standard error: 2.547 on 2935706 degrees of freedom  
Multiple R-squared:  0.05448,  Adjusted R-squared:  0.05443  
F-statistic:  1191 on 142 and 2935706 DF,  p-value: < 2.2e-16
```

UNFORTUNATELY, the accuracy of the linear regression model is low.

Probably because of the

{ Large number of observations
Too many dummy variables

THEREFORE, we cannot use linear regression to predict future sales.

HOWEVER...

Since most of the **coefficients** are significant, we can still get some useful information.

Some of the **shop_ids** and **item_category_ids** have a **negative** effect on sales.

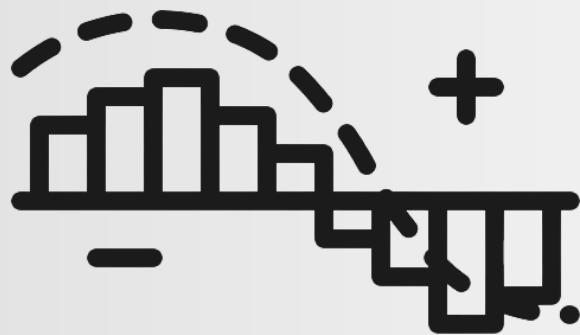
- This means that the sales in these shops are actually smaller than 0. This counter-intuitive phenomenon is probably because sale promotion.

PS4	2013	2014	2015
SHOP9_COEF	5.18	2.91	5.13
_CONS	1.48	1.08	1.01



shop_id50	-0.093947
shop_id51	-0.143321
shop_id52	-0.153576
shop_id53	-0.142355
item_category_id25	0.062883
item_category_id26	-6.236268
item_category_id27	-6.489016
item_category_id28	0.475545
item_category_id29	0.844986
item_category_id3	0.202036
item_category_id30	0.342220
item_category_id31	-5.788788

- Sale in **2013** is the highest, then drops a lot in **2014**, and recover to a level slightly lower than **2013** in **2015**.

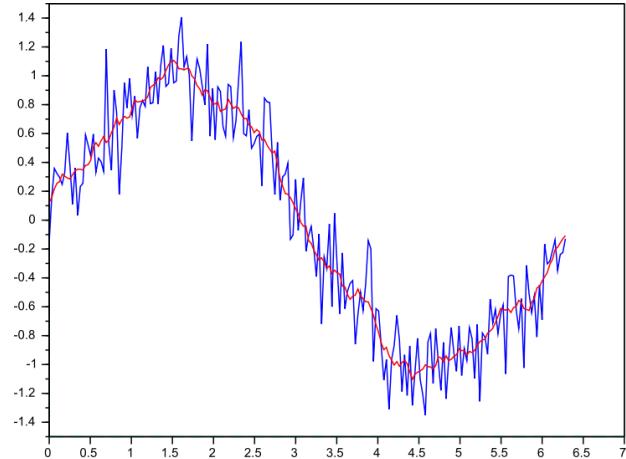


/04
**MOVING
AVERAGE**

MOVING AVERAGE

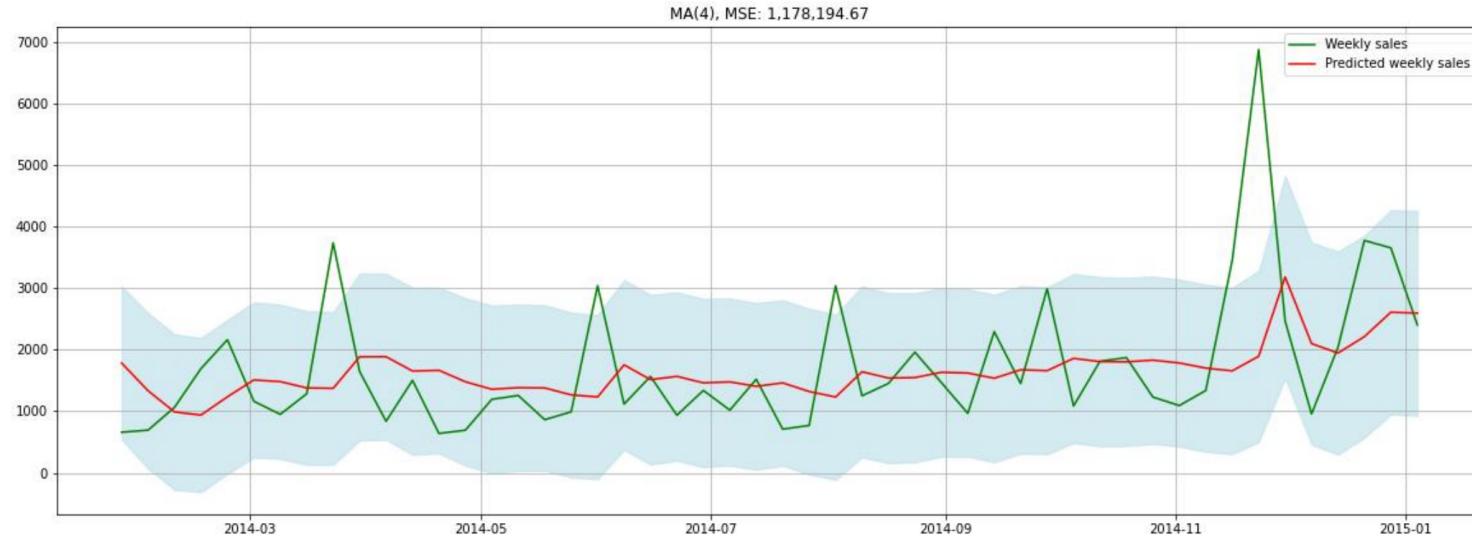
$$\begin{aligned}
 SMA_{k,next} &= \frac{1}{k} \sum_{i=n-k+2}^{n+1} p_i \\
 &= \frac{1}{k} \left(\underbrace{p_{n-k+2} + p_{n-k+3} + \cdots + p_n}_{\sum_{i=n-k+2}^{n+1} p_i} + p_{n+1} + \underbrace{p_{n-k+1} - p_{n-k+1}}_{=0} \right) \\
 &= \frac{1}{k} \left(p_{n-k+1} + p_{n-k+2} + \cdots + p_n \right) - \frac{p_{n-k+1}}{k} + \frac{p_{n+1}}{k} \\
 &\quad = \overbrace{SMA_{k,prev}}^{\text{---}} \\
 &= SMA_{k,prev} + \frac{1}{k} \left(p_{n+1} - p_{n-k+1} \right)
 \end{aligned}$$

APPLY
→



A moving average is commonly used with time series data to smooth out short-term fluctuations and highlight longer-term trends or cycles.

2014 PREDICTION FOR SONY PS4



3.3%

PLAIN PART

252%

BURST PART

2015 PREDICTION WITH COMPARISON



SONY PS4



XBOX ONE



Introduction

Problems

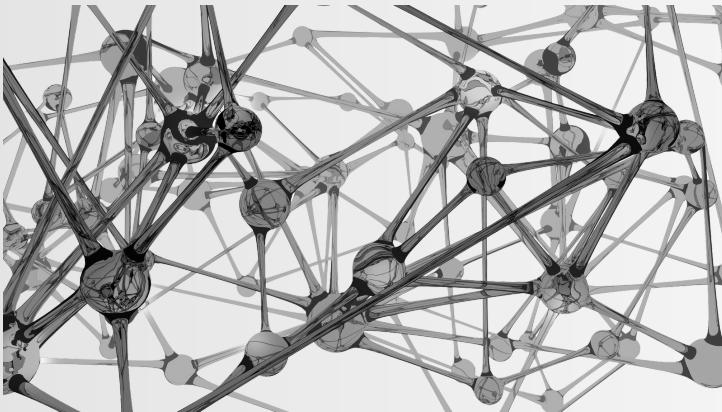
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LSTM

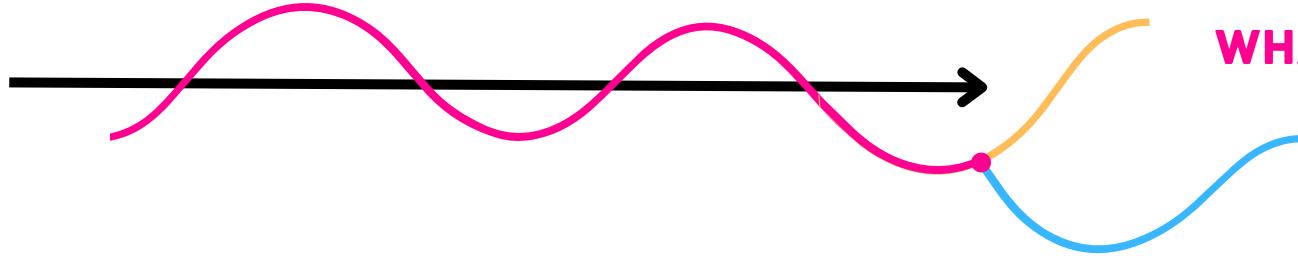
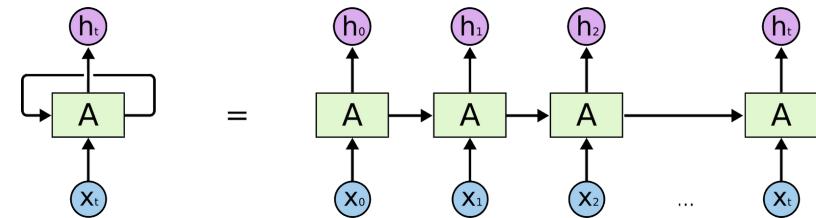
WHAT IS LSTM?

A NEURAL NETWORK

A temporal recurrent neural network (RNN).

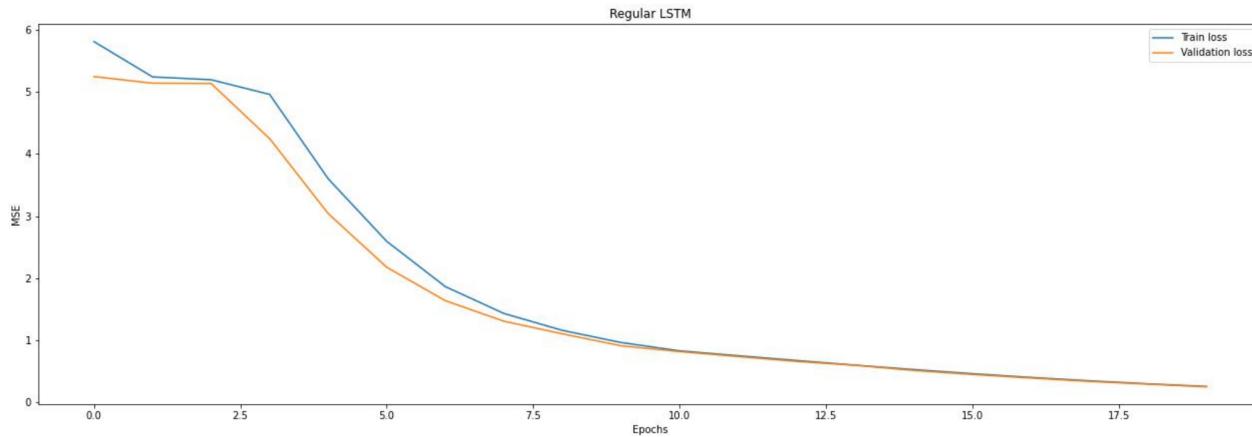
Suitable for processing and predicting important events with very long intervals and delays in time series.

The LSTM will transfer memories in a very precise way : which parts of the information need to be remembered, updated and noticed.



WHAT'S GOING ON ?

MODEL PERFORMANCE



Epochs 20/20

Total: 58.3s (3s/step average)

Regular LSTM model:
Train rmse: 0.48255
Validation rmse: 0.49435

2015 PREDICTION WITH COMPARISON

	Accessories	Console	Games
PS4	775.07	240.01	4117.44
XboxOne	346.83	161.54	1662.76

ADVANTAGE:

- Regression and fitted result
- A more accurate modification



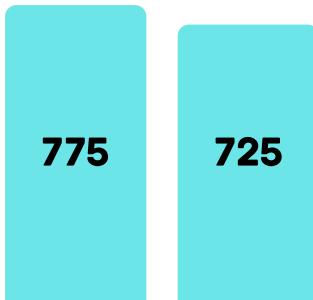


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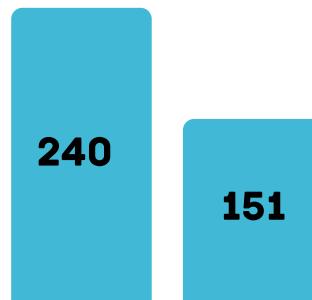
IMPLICATION

KEY RESULTS: PS4 CATEGORIES SALES

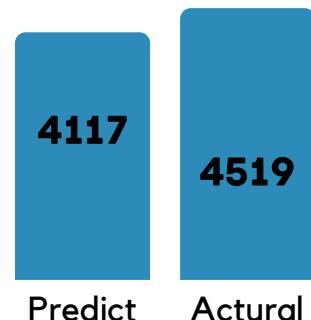
ACCESSORIES SALES
MONTHLY 2015



GAME CONSOLES
SALES MONTHLY 2015



GAMES SALES
MONTHLY 2015



| **6.9%** of accessories less sales than predicted

| **9.8%** of games sales more than predicted

| **37.1%** of game consoles sales less than predicted

KEY RESULTS: PS4 STORE DISTRIBUTION

TOP 5 STORES OF SALES IN ACCESSORIES

	PREDICTED				
Store No.	25	31	28	42	21
R. Diff.	-1	+1	0	0	-3

	ACTUAL				
Store No.	31	25	28	42	47
R. Diff.	+1	-1	0	0	-2

TOP 5 STORES OF SALES IN CONSOLES

	PREDICTED				
Store No.	58 (Town)	42	15 (Town)	25	12
R. Diff.	-10	-2	-7	+2	+4

	ACTUAL				
Store No.	12	25	31	42	28 (MOW)
R. Diff.	+4	+2	+4	-2	+9

TOP 5 STORES OF SALES IN GAMES

	PREDICTED				
Store No.	25	31	42	28	21
R. Diff.	0	-1	+1	0	-6

	ACTUAL				
Store No.	25	42	31	28	12 (E-shop)
R. Diff.	0	+1	-1	0	+16

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KEY RESULTS: POST-WAR INDICATIONS

PRODUCTION



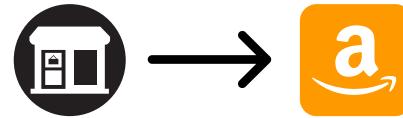
GAMES & ACCESSORIES

Increase 10% production - increased sales from cheaper pricing

GAME CONSOLES

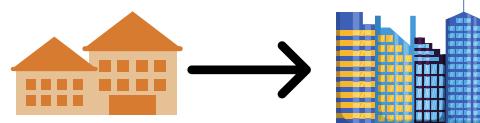
Cut 35% of production for \$400 expensive consoles

PLACES



GAMES PURCHASE: OFFLINE TO ONLINE

Monthly sales ranking on E-shop is much higher than predicted



GAME CONSOLES PURCHASE:

UNDERDEVELOPED AREAS TO DEVELOPED AREAS

Sales generally increased in Moscow shops while decreased in underdeveloped areas

CUSTOMERS BECOME PRICE-SENSITIVE

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KEY RESULTS: POST-WAR STRATEGIES

-
- Close franchise stores in underdeveloped areas
 - Distribute more game consoles to larger cities
 - Develop official online shops or cooperate with online platforms
 - Launch affordable game consoles, accessories and games

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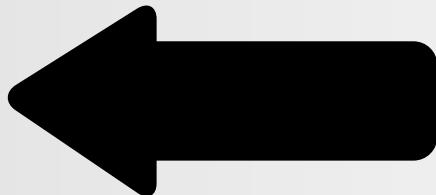
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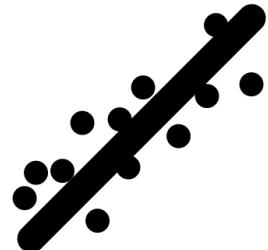
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END

/07
CONCLUSION

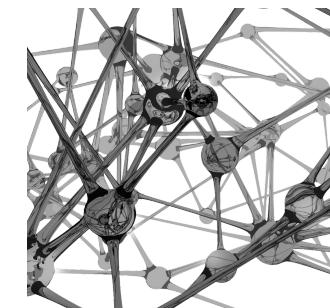
IN CONCLUSION



**LINEAR
REGRESSION**



**MOVING
AVERAGE**



LSTM

SONY
make.believe

THANK
YOU
&