AI-Powered Retail Products for Improved Customer Experience, Sales, and Inventory Management: A Business Proposal

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Abstract

This research outlines a retail solution powered by AI that can improve customer satisfaction, boost revenue, and improve inventory control for retailers. The product has virtual assistants for customer service, predictive analytics for inventory management, and personalized product suggestions. The data analytics module analyzes customer data and offers individualized recommendations using machine learning algorithms and NLP. The chatbot module offers virtual assistants for customer service using NLP and machine learning algorithms. Predictive analytics are used by the inventory management module to optimize inventory levels. These modules and their schematic are included in the product prototype. Businesses may enhance revenue, improve consumer engagement, and lower inventory costs with the aid of this AI-powered retail system.

Problem Statement:

Retail businesses struggle with providing customers with a customized experience, enhancing inventory management, and increasing sales. These issues result from the inability to adequately assess customer data, manage inventory, and provide tailored guidance. As a result, retailers miss out on opportunities to generate revenue, struggle to keep customers, and deal with inventory-related issues like overstocking and understocking.

Market/Customer/Business Need Assessment:

The retail sector is fiercely competitive, and customers demand convenience and individualized service. To stay ahead of the competition, keep customers, and boost sales, retailers must adopt cutting-edge technologies. By offering customized suggestions, virtual assistants for customer care, and predictive analytics for inventory management, AI-powered retail solutions can meet these objectives.

Target Specifications:

Small to medium-sized retail enterprises who want to improve customer service, boost sales, and improve inventory management are our target clients. Even though they may not have a lot of resources or experience with AI, they are eager to spend money on cutting-edge solutions that can enhance their business operations.

Benchmarking alternate products:

Amazon's personalized recommendations, Sephora's virtual assistant for beauty assistance, and Walmart's predictive analytics for inventory management are examples of current AI-powered retail items. Our product will set itself apart by offering a full range of AI-powered solutions that are specifically suited to the requirements of small to medium-sized stores.

Business Model:

Our company will operate on a subscription basis, with several levels dependent on the quality of the services offered. Customers have the option of subscribing to a basic package that includes tailored product recommendations or a premium package that includes virtual assistants for customer service and predictive analytics for inventory management. Additionally, we will charge a one-time implementation fee to companies that require help integrating our product into their current systems.

Concept Generation:

We carried out a requirements analysis and determined the main difficulties that small to medium-sized retail enterprises confront. After that, we discussed potential AI-based approaches to these problems.

Concept Development:

Our product will be a suite of AI -powered retail solutions that include the following:

Our offering will be a collection of retail solutions powered by AI, such as:

Product recommendations that are specifically tailored to each consumer are given by our AI algorithms after analyzing their browsing and purchase patterns. Sales will be boosted and customer engagement will rise as a result.

Customer service virtual assistants: Our AI-powered chatbots will instantly assist consumers and respond to their questions about goods, delivery, and refunds. Customers will have a better overall experience as a result, and customer support agents will work less.

Predictive Analytics for Inventory Management: Using inventory data analysis, our AI algorithms will forecast demand and optimize stock levels. This will stop overstocking and understocking, lower the cost of the inventory, and boost sales.

Final Product Prototype:

The data analytics module, the chatbot module, and the inventory management module will make up the core elements of our AI-powered retail offering.

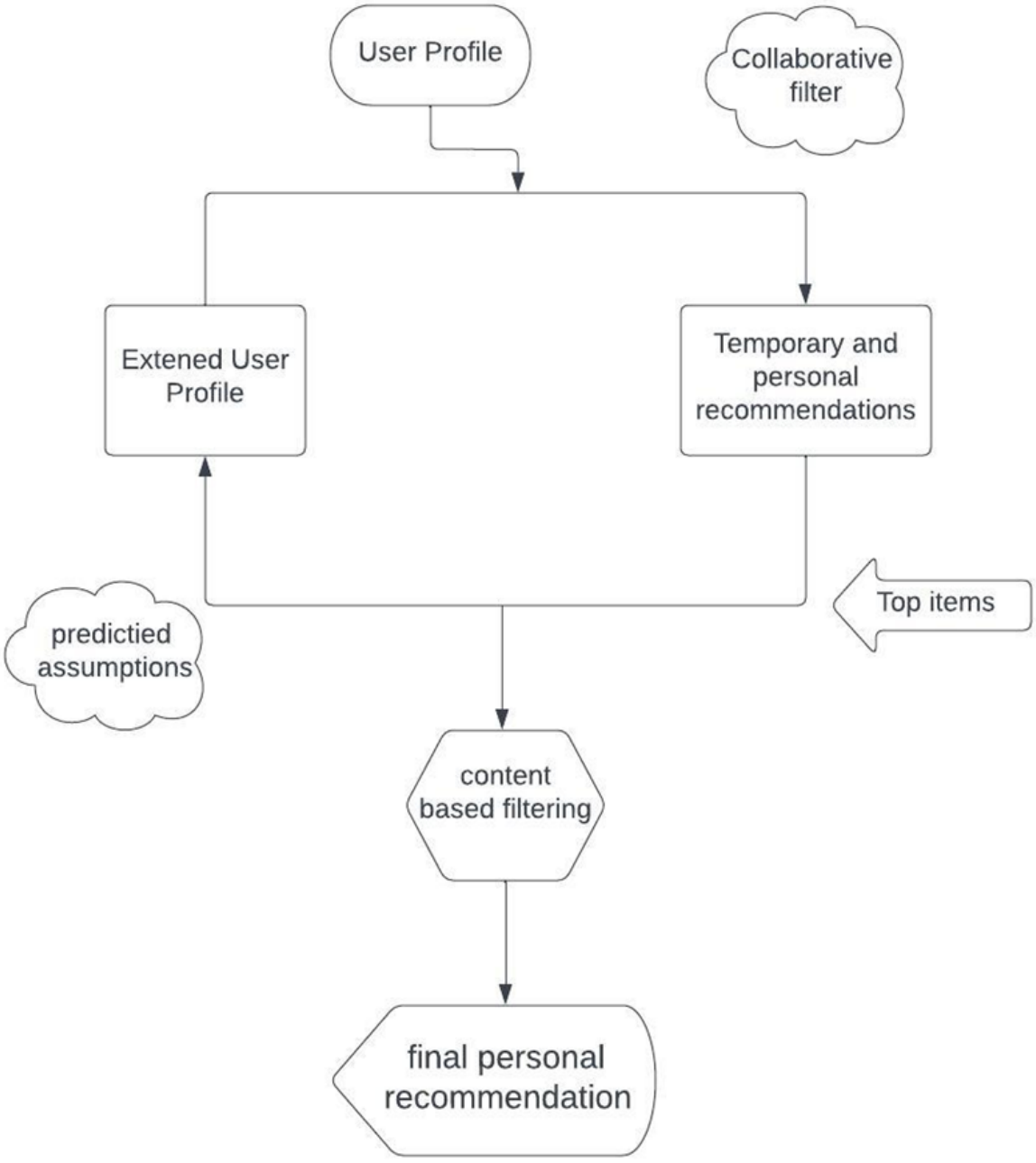
Data analytics module: To make individualized product recommendations, this module will examine client data. In order to examine client browsing and purchasing patterns, machine learning methods like collaborative filtering and content-based filtering will be used. Natural language processing (NLP) will also be used in the module to analyze customer reviews and feedback and offer insights to improve product offerings.

Customer support virtual assistants will be offered through the chatbot module. In order to comprehend customer inquiries and deliver precise responses, it will use NLP and machine learning algorithms. Also, the chatbot will be able to deal with complex questions and, if necessary, divert clients to real people.

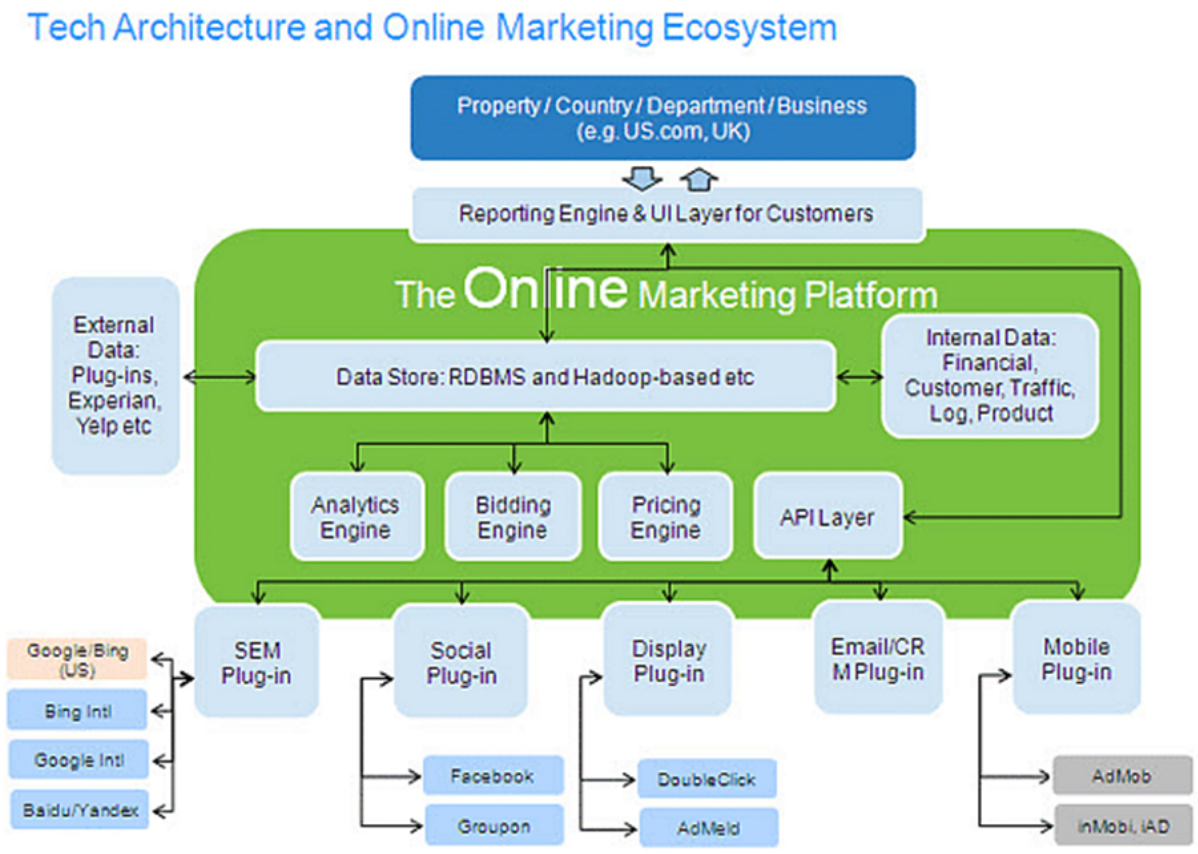
Predictive analytics will be used in the inventory management module to optimize inventory levels. In order to anticipate demand and optimize inventory levels, it will examine sales data, demand predictions, and supplier lead times. Also, the module will send notifications regarding inventory-related problems including overstocking and understocking.

Schematic Diagram:

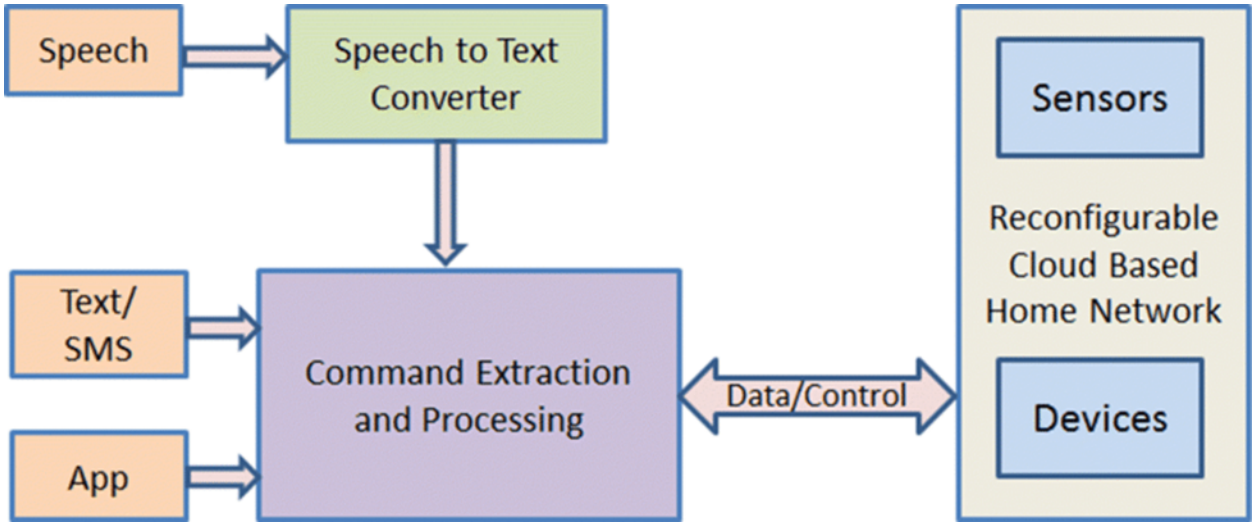
Product Recommendation System:



Walmart predictive analytics for inventory management:



Customer service virtual assistants:



The data analytics module will receive data from the customer database and product catalog. The chatbot module will receive data from the customer database and inventory database. The inventory management module will receive data from the inventory database and sales database. The modules will use machine learning algorithms and NLP to provide personalized product recommendations, virtual assistants for customer service, and predictive analytics for inventory management.

How does the product function?

The retail system driven by AI will function by evaluating consumer data to offer personalized product suggestions, supplying virtual assistants for customer care, and anticipating inventory levels for the best inventory management. The three parts that make up the system are data analytics, chatbots, and inventory management.

Sources of data Customer, sales, inventory, and supplier data are some of the data sources for the retail solution. The information will be obtained through a variety of methods, including social media, consumer satisfaction surveys, and point-of-sale (POS) systems.

Needed are algorithms, frameworks, software, etc. Natural language processing, collaborative filtering, content-based filtering, and predictive analytics algorithms are all examples of machine learning algorithms that will be needed for the solution. Software like Python, TensorFlow, and Keras as well as frameworks like Flask and Django will also be needed.

Team needed to create: UX designers, software engineers, and data scientists will all be on the development team. The three parts of the solution will be created by the team and combined into a single unit.

What is the price?

The price will vary based on the difficulty of the solution and the hourly rate of the team. The cost will also be affected by the infrastructure of hardware and software needed to run the solution.

Code Implementation:

Rossmann operates over 3,000 drug stores in 7 European countries. Currently, Rossmann store managers are tasked with predicting their daily sales for up to six weeks in advance. Store sales are influenced by many factors, including promotions, competition, school and state holidays, seasonality, and locality. With thousands of individual managers predicting sales based on their unique circumstances, the accuracy of results can be quite varied.

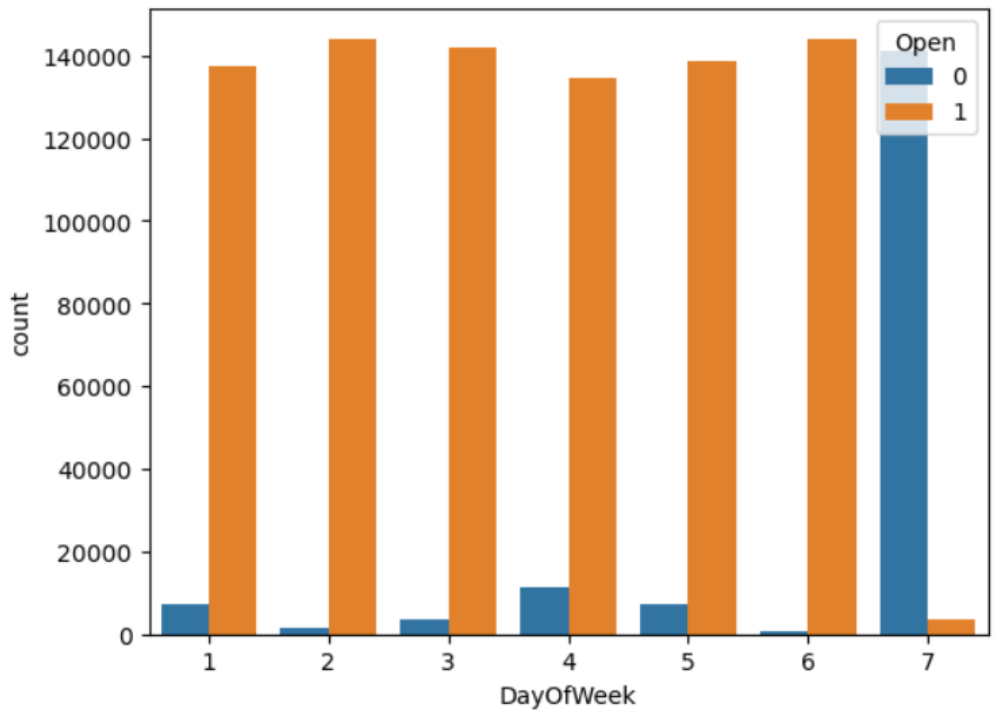
Data Description

- **Id - an Id that represents a (Store, Date) duple within the test set**
- **Store - a unique Id for each store**
- **Sales - the turnover for any given day (this is what you are predicting)**
- **Customers - the number of customers on a given day**
- **Open - an indicator for whether the store was open: 0 = closed, 1 = open**
- **StateHoliday - indicates a state holiday. Normally all stores, with few exceptions, are closed on state holidays. Note that all schools are closed on public holidays and weekends. a = public holiday, b = Easter holiday, c = Christmas, 0 = None**
- **SchoolHoliday - indicates if the (Store, Date) was affected by the closure of public schools**
- **StoreType - differentiates between 4 different store models: a, b, c, d**
- **Assortment - describes an assortment level: a = basic, b = extra, c = extended**
- **CompetitionDistance - distance in meters to the nearest competitor store**
- **CompetitionOpenSince[Month/Year] - gives the approximate year and month of the time the nearest competitor was opened**
- **Promo - indicates whether a store is running a promo on that day**

- **Promo2 - Promo2 is a continuing and consecutive promotion for some stores: 0 = store is not participating, 1 = store is participating**
- **Promo2 Since[Year/Week] - describes the year and calendar week when the store started participating in Promo2**
- **PromoInterval - describes the consecutive intervals Promo2 is started, naming the months the promotion is started anew. E.g. "Feb,May,Aug,Nov" means each round starts in February, May, August, November of any given year for that store**

As we can see that in the graph given below that Stores mainly closed on Sunday

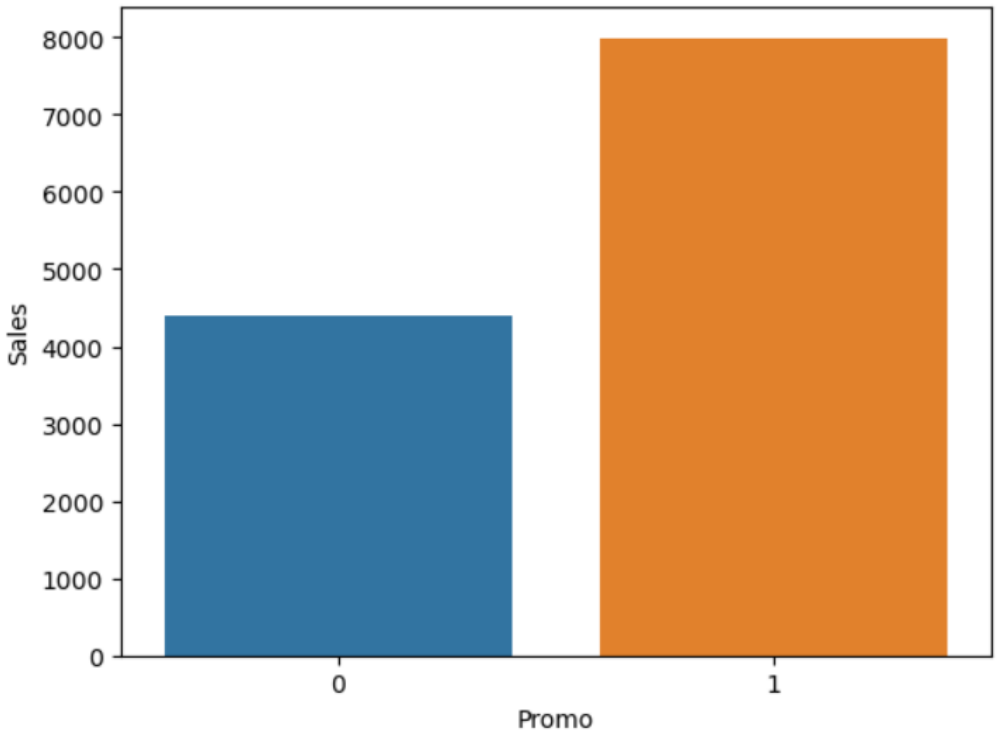
```
In [22]: sns.countplot(x='DayOfWeek',hue='Open',data=df)
Out[22]: <AxesSubplot:xlabel='DayOfWeek', ylabel='count'>
```



Sales Are nearly doubled High When Promo is Running

In [23]:
```
#Impact of promo on sales
Promo_sales = pd.DataFrame(df.groupby('Promo').agg({'Sales':'mean'}))
sns.barplot(x=Promo_sales.index, y = Promo_sales['Sales'])
```

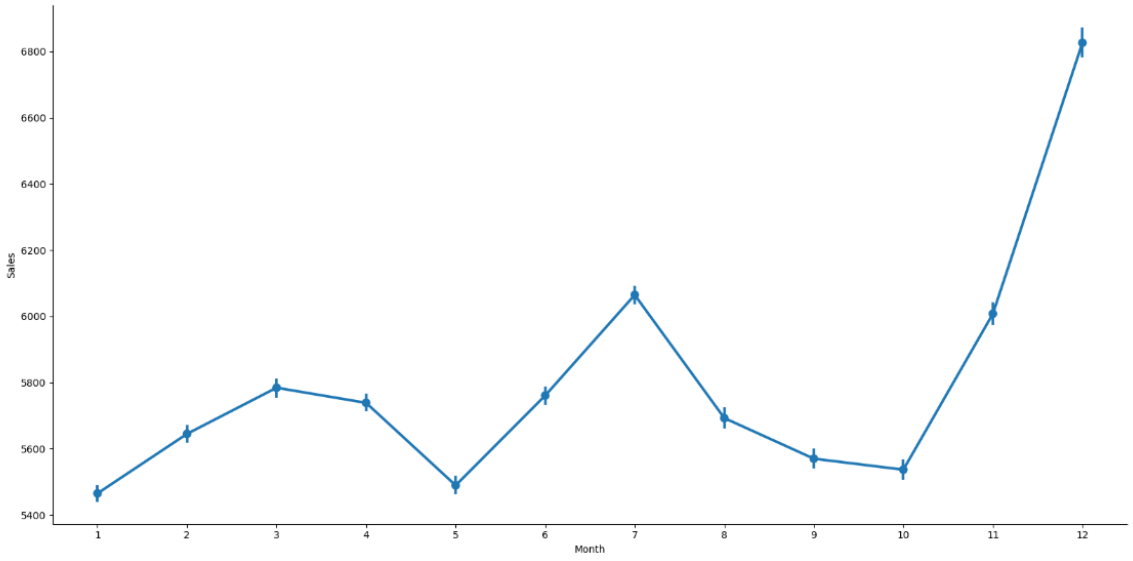
Out[23]: <AxesSubplot:xlabel='Promo', ylabel='Sales'>



As We can see that In the month of November and Specially in December Sales is increasing Rapidly every year on the christmas eve.

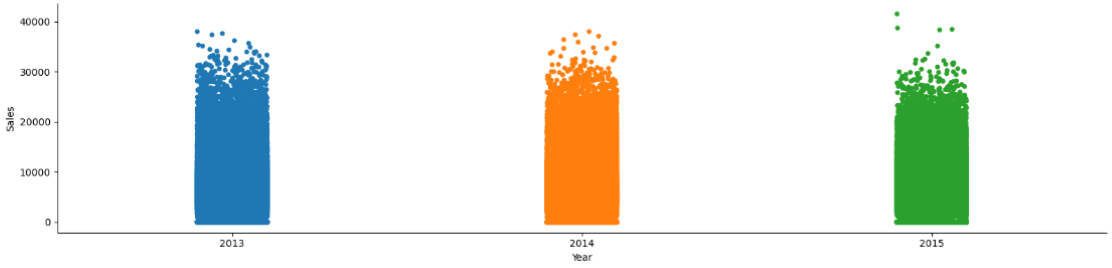
In [28]:
```
import warnings
warnings.filterwarnings('ignore')
sns.factorplot(x="Month" ,y = "Sales" , data=df, kind="point", aspect=2,size=8)
```

Out[28]: <seaborn.axisgrid.FacetGrid at 0x1c58e2d20d0>



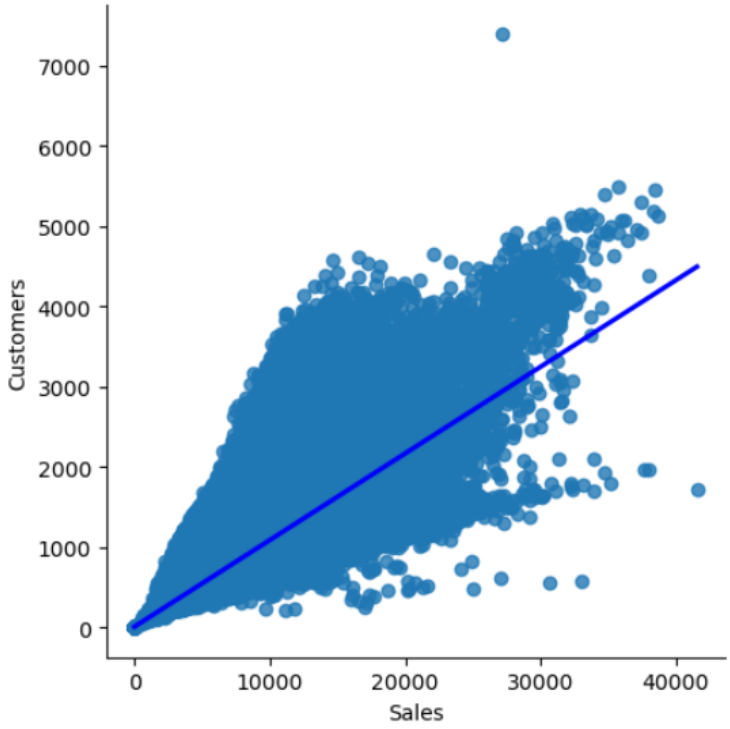
We can see that there is not such significant differences in these 3 years in terms of sales.

In [14]:
```
#plotting year vs sales
sns.catplot(x='Year',y='Sales',data=df, height=4, aspect=4 );
```



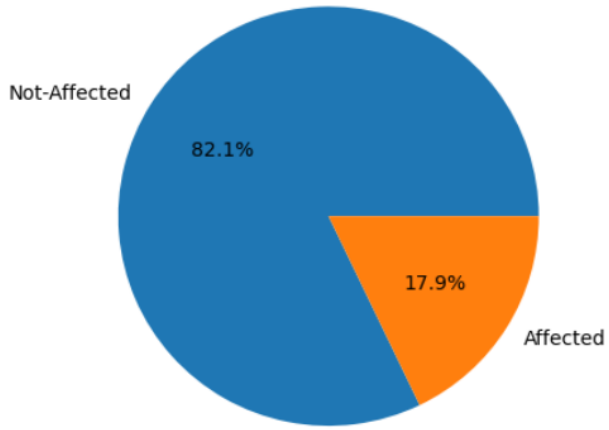
In [13]:
```
#linear relation between sales and customers
sns.lmplot(x= 'Sales' , y ='Customers',data=df, height=5,aspect=1, line_kws={'color':'blue'})
```

Out[13]: <seaborn.axisgrid.FacetGrid at 0x1f584e7d7c0>



As we can see in the Piechart Sales affected by School Holiday is 18% and Mainly Sales aren't afffected by School Holiday

In [25]:
```
labels = 'Not-Affected' , 'Affected'
sizes = df.SchoolHoliday.value_counts()
plt.pie(sizes, labels=labels,
        autopct='%1.1f%%')
plt.show()
```



We predicted the Sales of the company by using random forest and got the accuracy of:

Model Score : 0.9855403988998304 , Test Score : 0.913549796683473 and R2 score of 0.913549796683473

In [46]:
```
#%%time
rdf = RandomForestRegressor(n_estimators=80,min_samples_split=2, min_samples_leaf=1,max_depth=None,n_jobs=-1)
rdfreg = rdf.fit(X_train, y_train)
train_score=rdfreg.score(X_train, y_train)
test_score=rdfreg.score(X_test, y_test)

print("Regresion Model Score" , ":" , train_score, "," ,
      "Test Score" ,":" , test_score)

y_predicted = rdfreg.predict(X_train)
y_test_predicted = rdfreg.predict(X_test)
```

```
Regresion Model Score : 0.9855403988998304 , Test Score : 0.913549796683473
```

In [48]:
```
r2= r2_score(y_test, y_test_predicted)
```

In [49]:
```
r2
```

Out[49]:
```
0.913549796683473
```

Github link: https://github.com/spandyy/Feynn-Labs-/blob/main/project%201.ipynb

Conclusion of the analysis:

Sales are highly correlated to the number of Customers.

The most selling and crowded store type is A.

StoreType B has the lowest Average Sales per Customer. So I think customers visit this type only for small things.

StoreTybe D had the highest buyer cart.

Promo runs only on weekdays.

For all stores, Promotion leads to increase in Sales and Customers both.

More stores are opened during School holidays than State holidays.

The stores which are opened during the School Holiday have more sales than normal days.

Sales are increased during Christmas week, this might be due to the fact that people buy more beauty products during a Christmas celebration.

Promo2 doesn't seem to be correlated to any significant change in the sales amount.

Absence of values in features CompetitionOpenSinceYear/Month doesn’t indicate the absence of competition as CompetitionDistance values are not null where the other two values are null.

Conclusion:

An AI-powered retail system may greatly enhance customer satisfaction, boost revenue, and streamline inventory control for retail establishments. Businesses can offer customized product suggestions and virtual assistants for customer support while also improving their inventory levels by utilizing machine learning algorithms and predictive analytics. Although the implementation of this solution may be expensive, it may have substantial long-term advantages for businesses.

External Search:

The following sources were used for research and information gathering:

McKinsey & Company. June 24, 2021 | Podcast
https://www.mckinsey.com/industries/retail/our-insights/how-tech-will-revolutionize-retail

Forbes. The 20 Best Examples Of Using Artificial Intelligence For Retail Experiences
https://www.forbes.com/sites/blakemorgan/2019/03/04/the-20-best-examples-of-using-artificial-intelligence-for-retail-experiences/?sh=12f4e66d4466

Harvard Business Review. How AI is Changing the Way We Manage Inventory. https://hbr.org/2018/07/how-ai-is-changing-sales