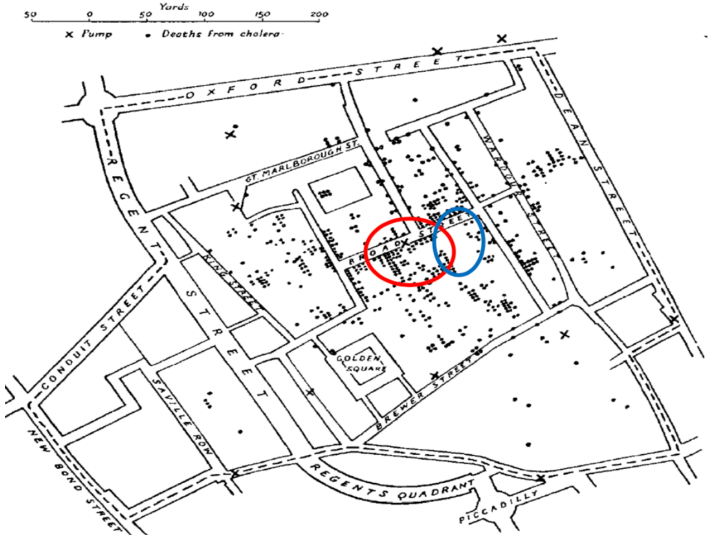
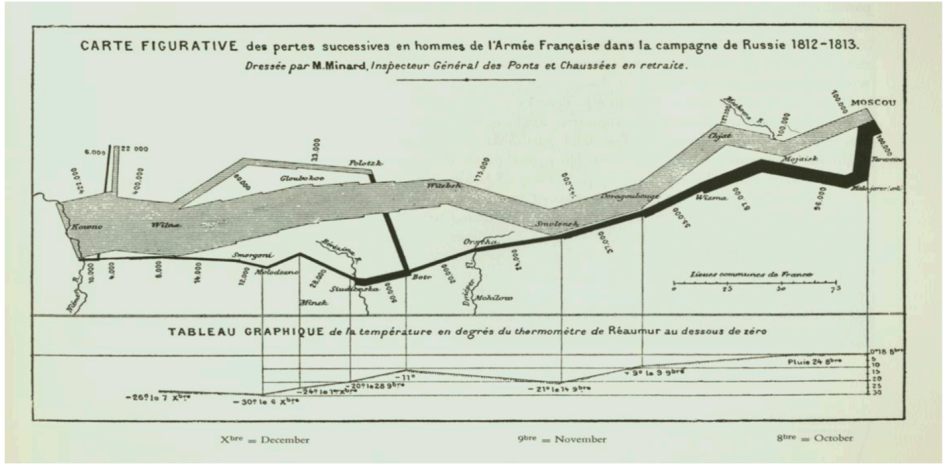
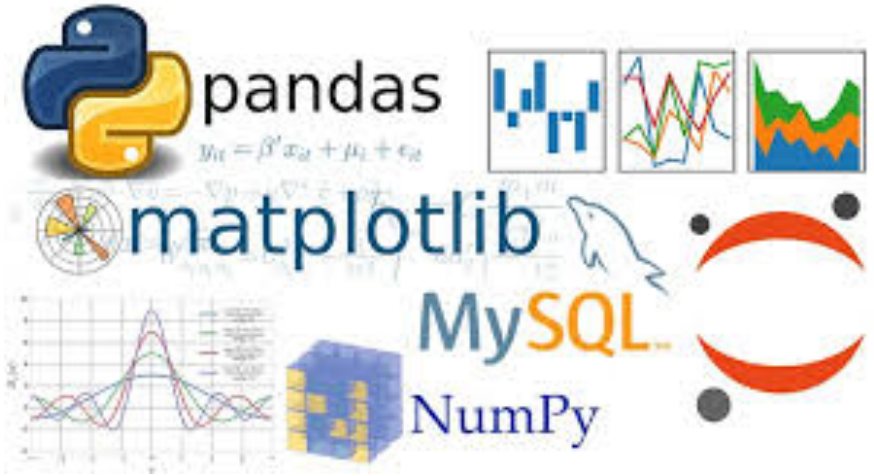
Data Visualization

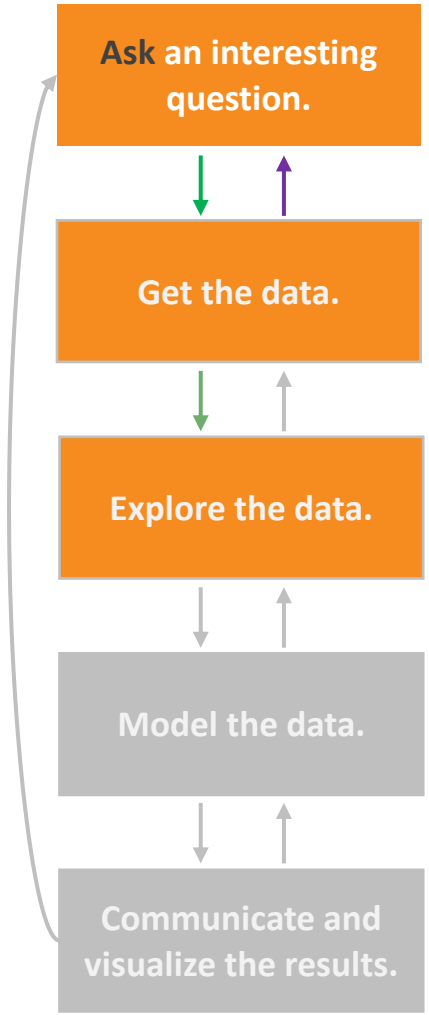
Motivation

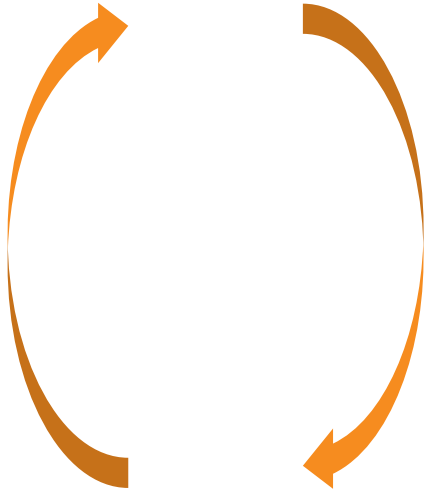

Yards
Pump
Deaths from cholera
OXFORD STREET
REGENT STREET
GOLDEN SQUARE
REGENTS QUADRANT
PICCADILLY
NEW BOND STREET

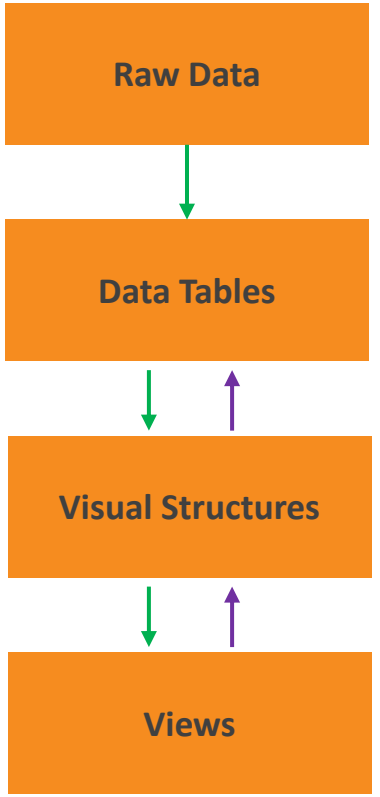

CARTE FIGURATIVE des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.
MOSCOU
TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro
Xbre = December
9bre = November
8bre = October


pandas
matplotlib
MySQL
NumPy

Get the Data and Explore the Data







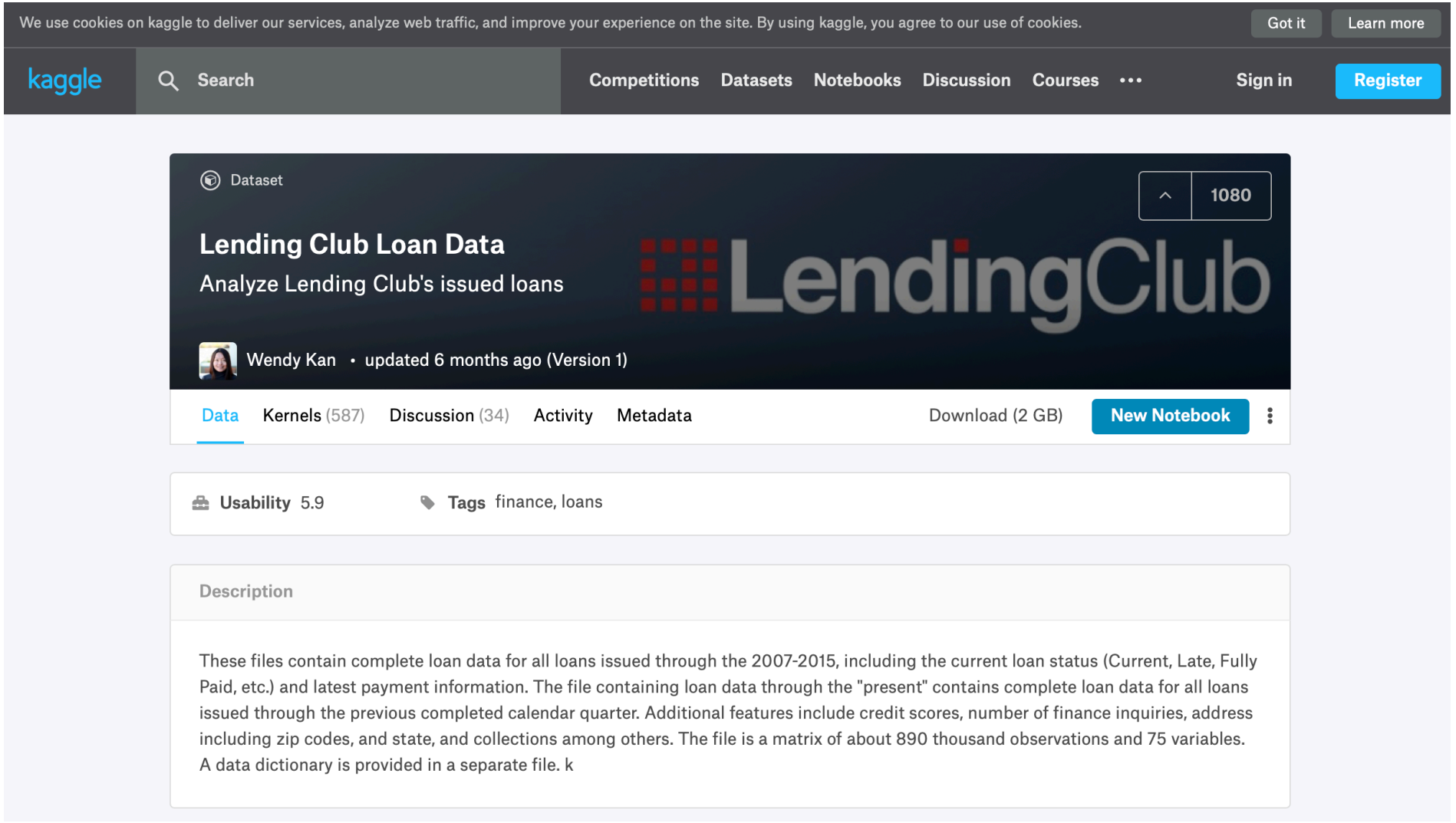
What is the **goal** of visualization?
What do you want to **understand**?

How is the data **sampled**?
Which data is **relevant**??

Plot the data.
Are there **anomalies**?
Are there **patterns**?

Build a Visualization.
Do the results make **sense?**

Our Data set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Discussion
Courses
Sign in
Register
Dataset
1080
Lending Club Loan Data
Analyze Lending Club's issued loans
LendingClub
Wendy Kan • updated 6 months ago (Version 1)
Data
Kernels (587)
Discussion (34)
Activity
Metadata
Download (2 GB)
New Notebook
Usability 5.9
Tags finance, loans
Description
These files contain complete loan data for all loans issued through the 2007-2015, including the current loan status (Current, Late, Fully Paid, etc.) and latest payment information. The file containing loan data through the "present" contains complete loan data for all loans issued through the previous completed calendar quarter. Additional features include credit scores, number of finance inquiries, address including zip codes, and state, and collections among others. The file is a matrix of about 890 thousand observations and 75 variables. A data dictionary is provided in a separate file. k

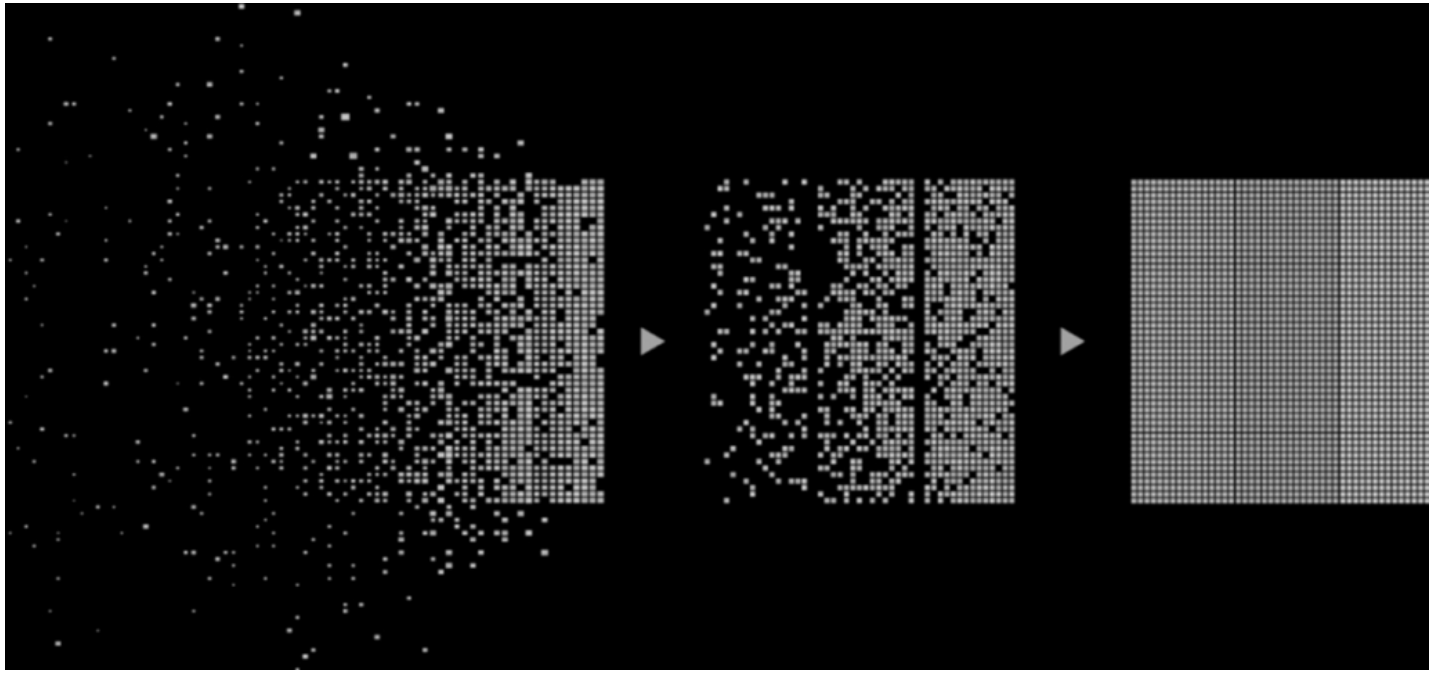
Why are insides so important?

auxmoney

Etc.

Investor Perspective

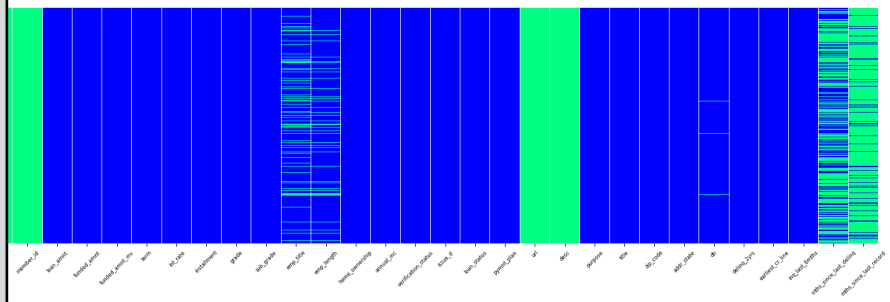
Step 1 – Pre-processing



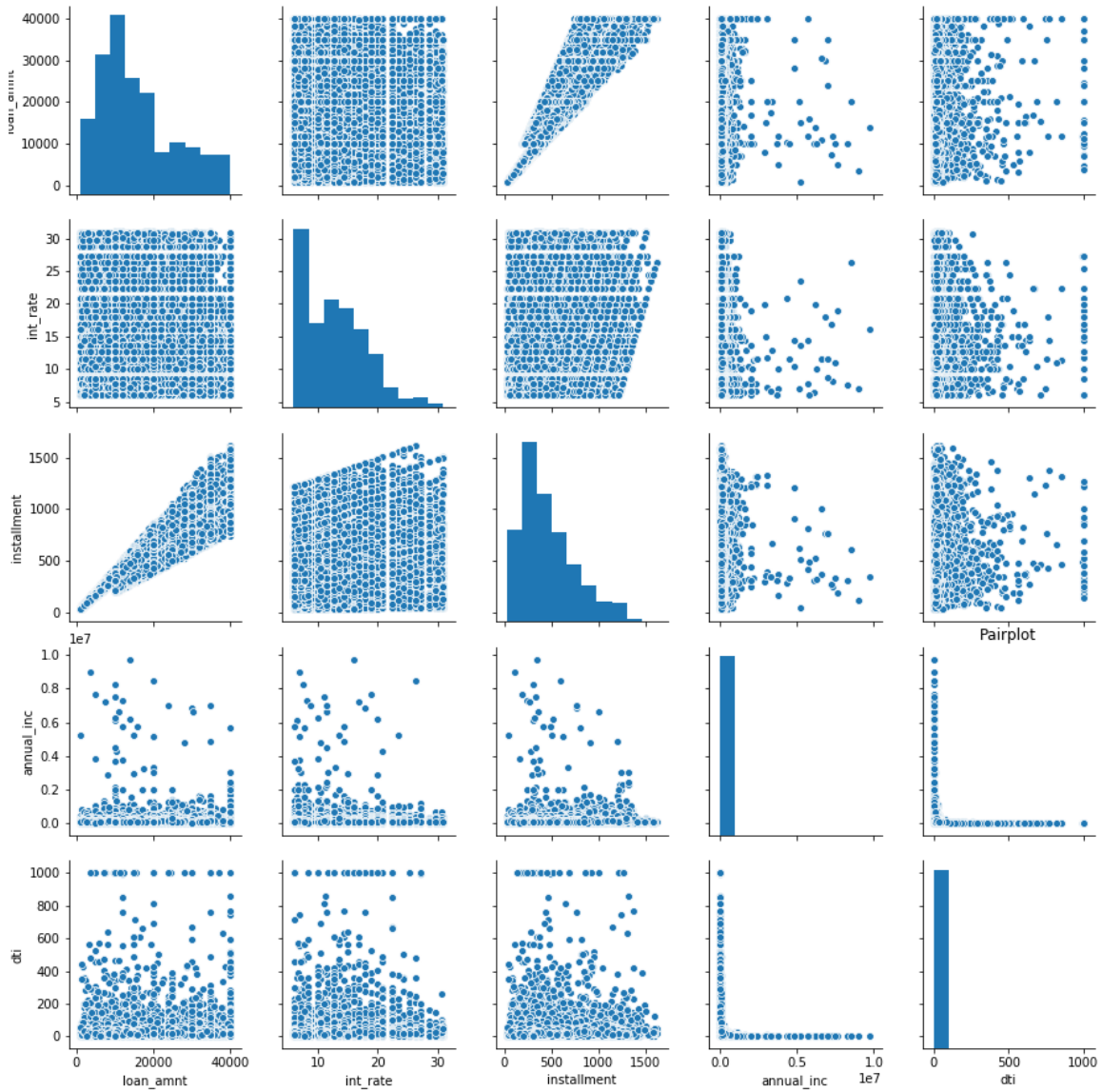
Pre-Processing

- Data pre-processing is an important step in the data mining process. The phrase "garbage in, garbage out" is particularly applicable to data mining and machine learning projects.
- Find all missing values.
- We should get an overview of the missing values.

```
plt.figure(figsize=(15,5))
sns.heatmap(df.isnull(), cbar=False,
yticklabels=False, cmap='winter')
plt.xticks(rotation=45, fontsize=6)
plt.tight_layout()
plt.savefig('figures/MissingValues.png')
plt.show()
plt.close()
```



Get an Overview (Feeling) of the data

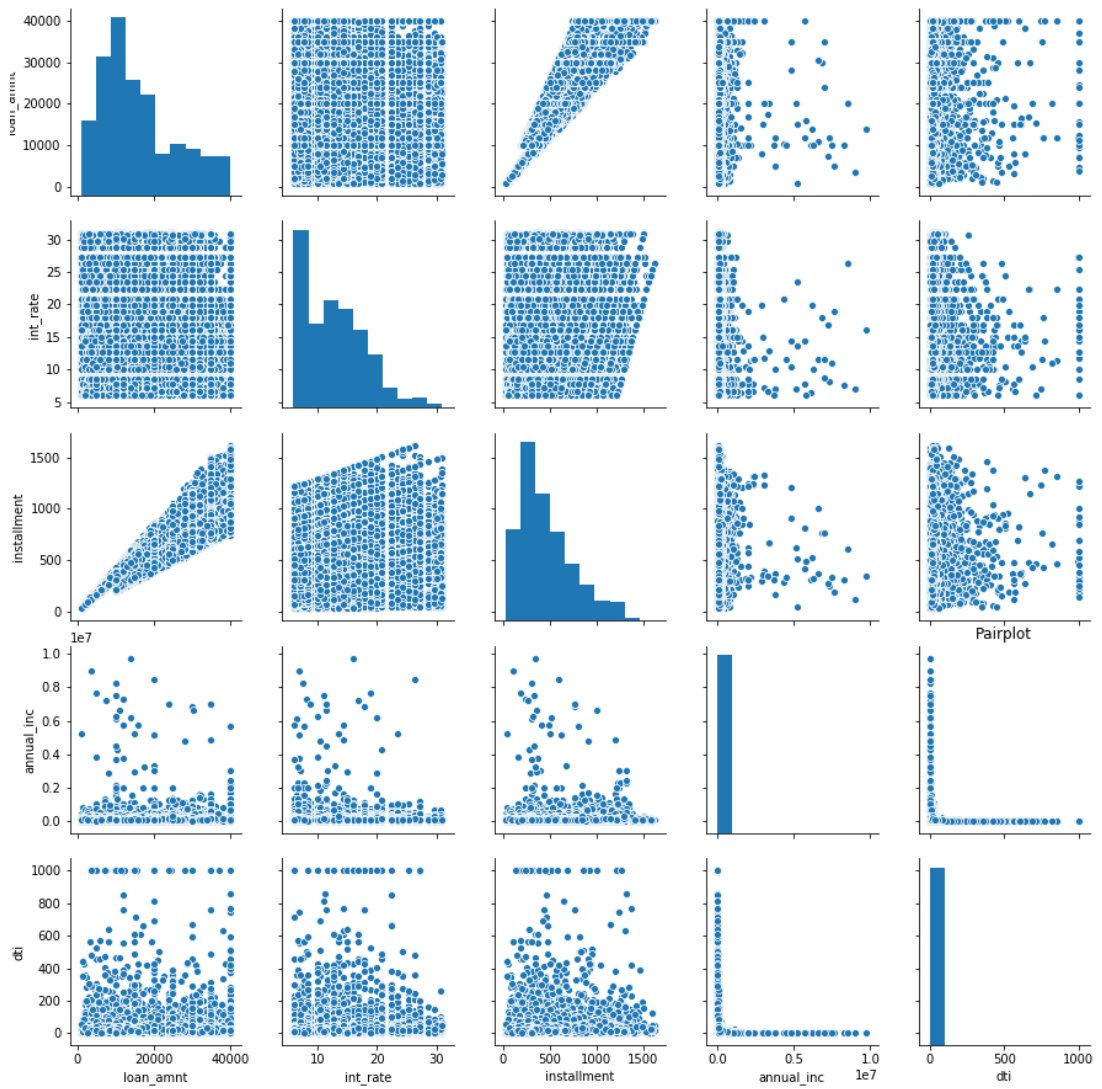


Get a Feeling of the Data – Pair Plot

- Plot pairwise relationships in a dataset

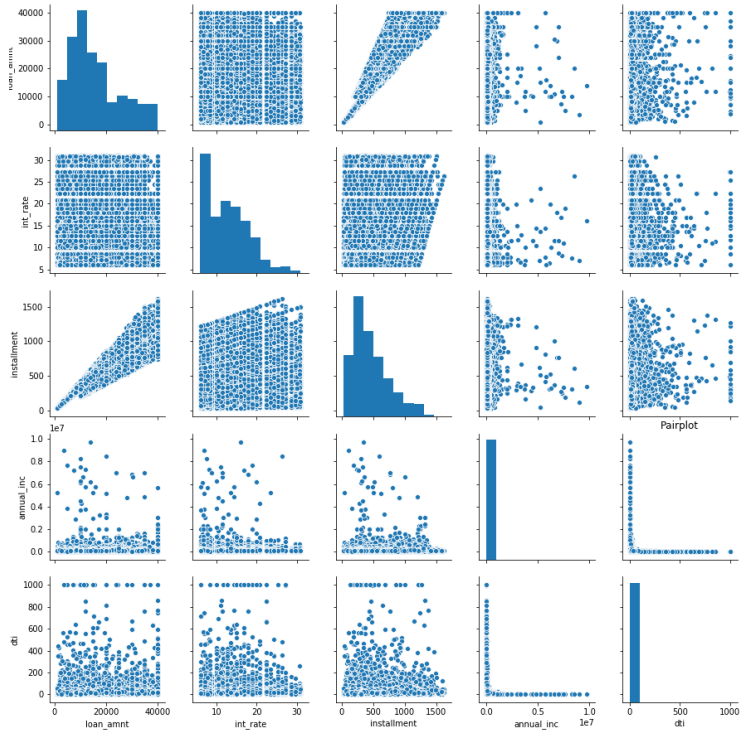
- Advantage:
  - Shows the pairwise relationship of data vectors from the Data Frame in the form of multiple scatter plots
  - Various analyses possible:
  - https://seaborn.pydata.org/generated/seaborn.pairplot.html

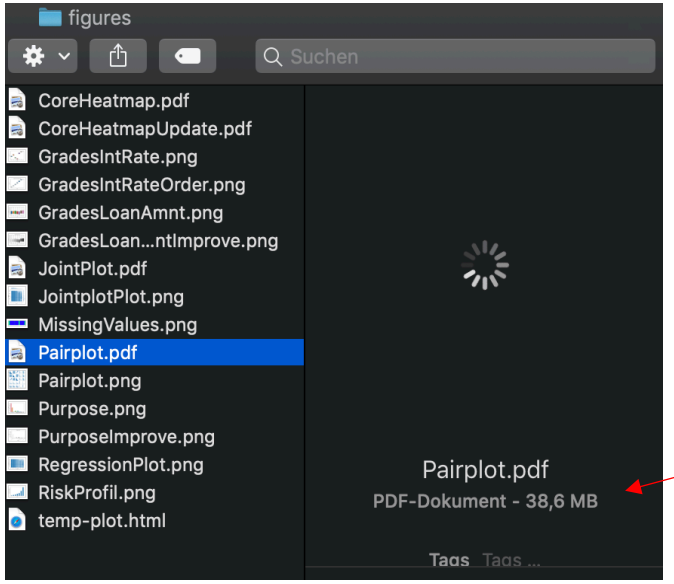
  - Disadvantage:
    - Requires quantitative data (transformation)
    - Required, depending on data complexity, **computing time**



Solution: Pairplot

```
plt.figure()
sns.pairplot(df[['loan_amnt', 'int_rate',
'installment', 'annual_inc', 'dti']])
plt.savefig('figures/Pairplot.png')
plt.show()
```



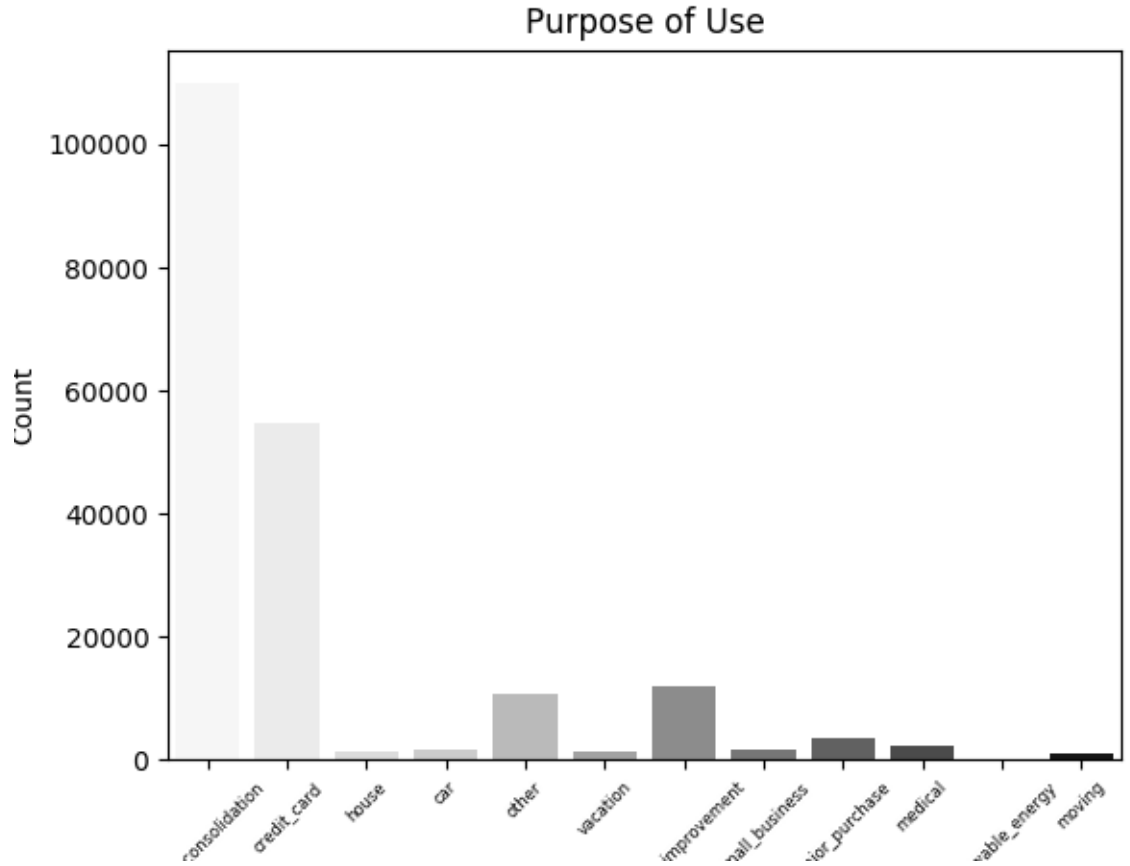


Complex representation, this is also shown by the pdf memory requirement

Ask an interesting question.

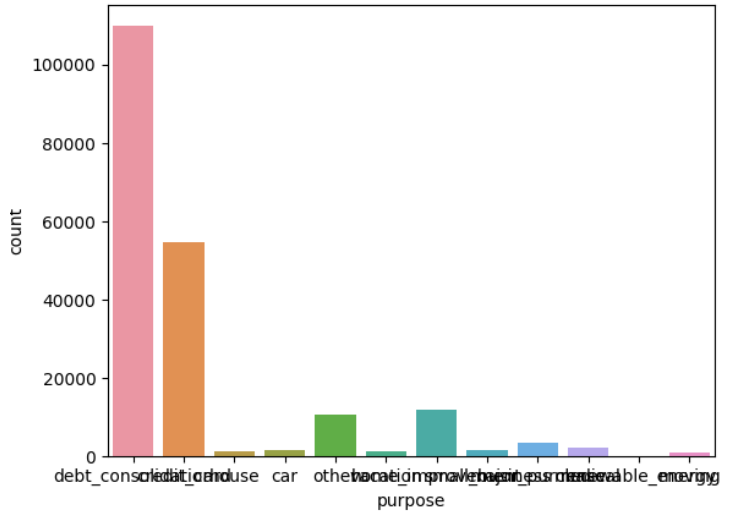
- Question: Purpose of Use?
- Why is this question relevant?

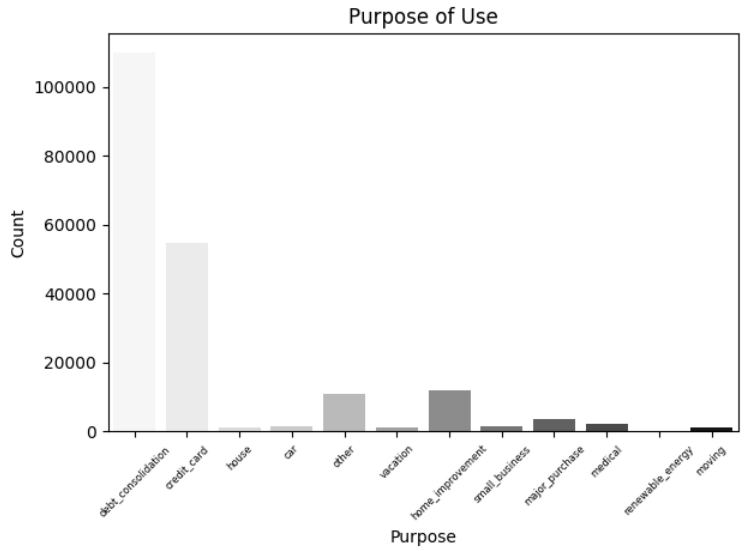
- Count Plot:
  - Show the counts of observations in each categorical bin using bars.



Solution: Upgrade Plot

```
ax = sns.countplot(x='purpose', data=df,
palette='Greys')
plt.xticks(rotation=45, fontsize=6)
plt.tight_layout()
plt.xlabel('Purpose')
plt.ylabel('Count')
plt.title('Purpose of Use')
plt.tight_layout()
plt.savefig('figures/PurposeImprov.png')
plt.show()
```



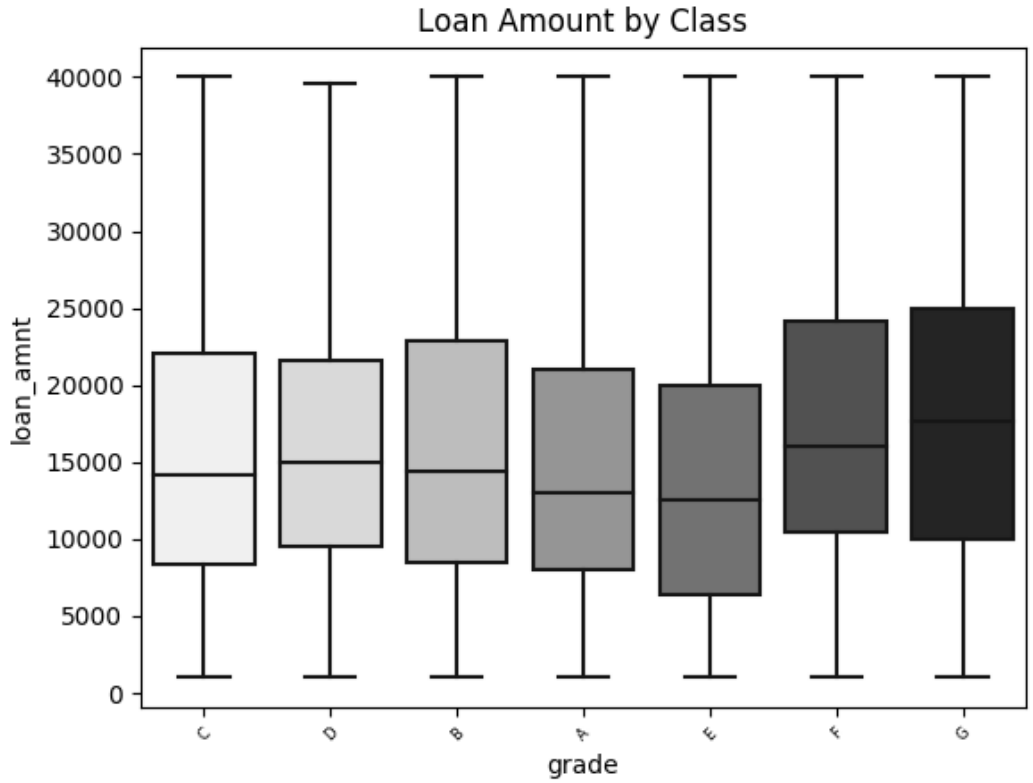


Risk-Class Analysis

- A credit rating is an evaluation of the credit risk of a prospective debtor (an individual, a business, company or a government)
- The credit rating represents an evaluation of a credit rating agency of the qualitative and quantitative information for the prospective debtor
- Usually grouped in groups from A to F
  - A = very good
  - G = junk

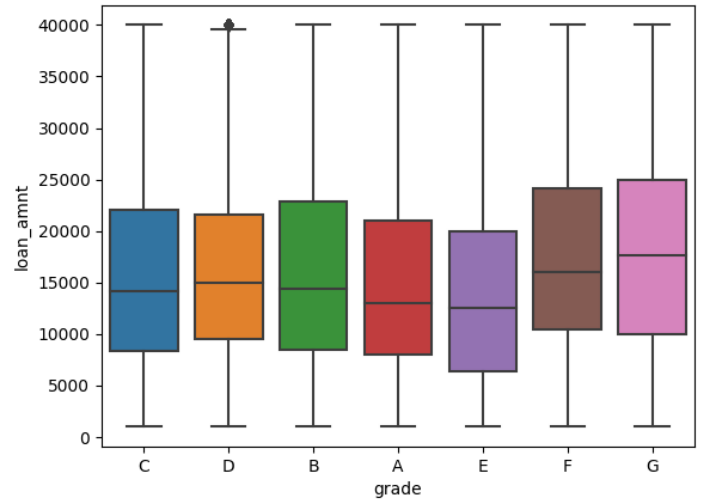
Ask an interesting question.

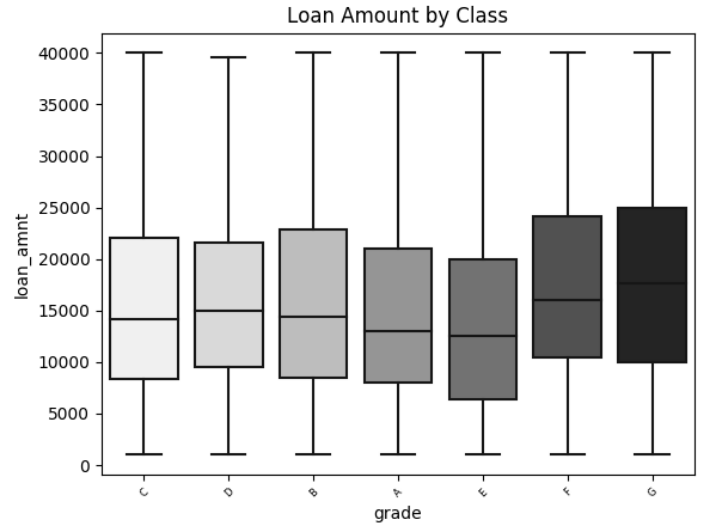
- Question: Loan amount by class?
- Why is this question relevant?
- Why could be a boxplot useful?



Upgrade Plot

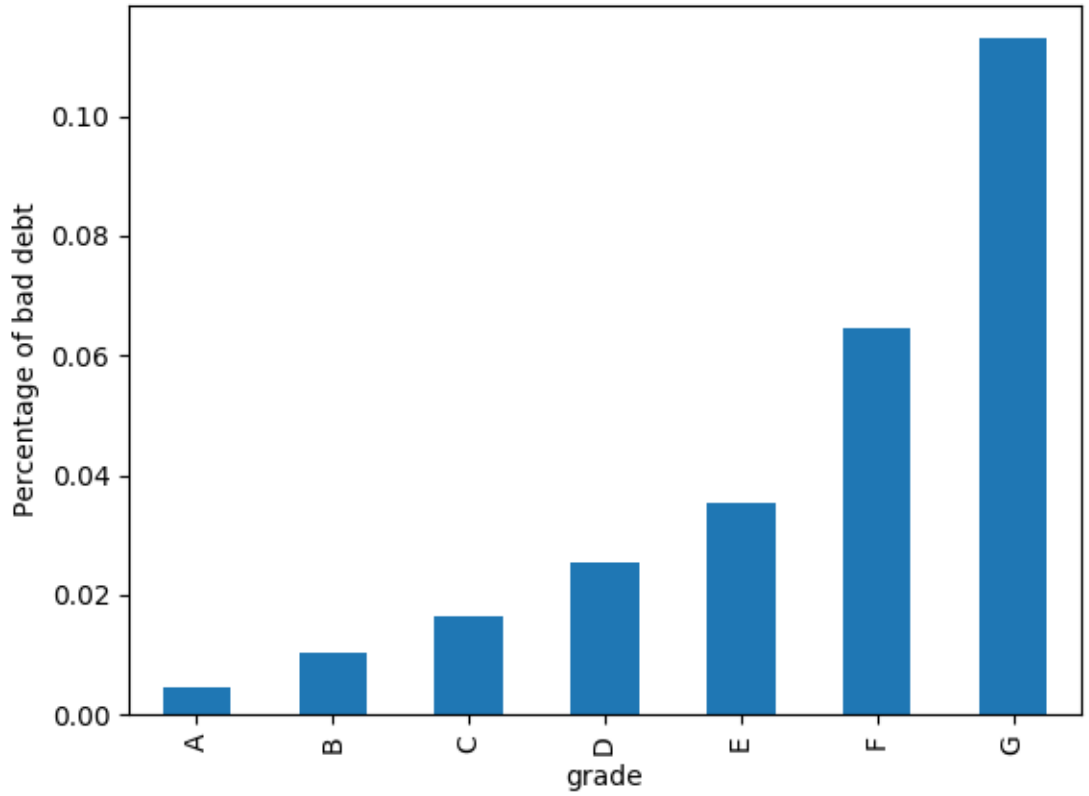
```
plt.figure()
sns.boxplot(x='grade', y='loan_amnt',
data=df, showfliers=False,
palette='Greys')
plt.xticks(rotation=45, fontsize=6)
plt.title('Loan Amount by Class')
plt.savefig('figures/GradesLoanAmntImpro
ve.png')
plt.show()
```





Ask an interesting question.

- Question: Probability of loss?
- Why is this question relevant?

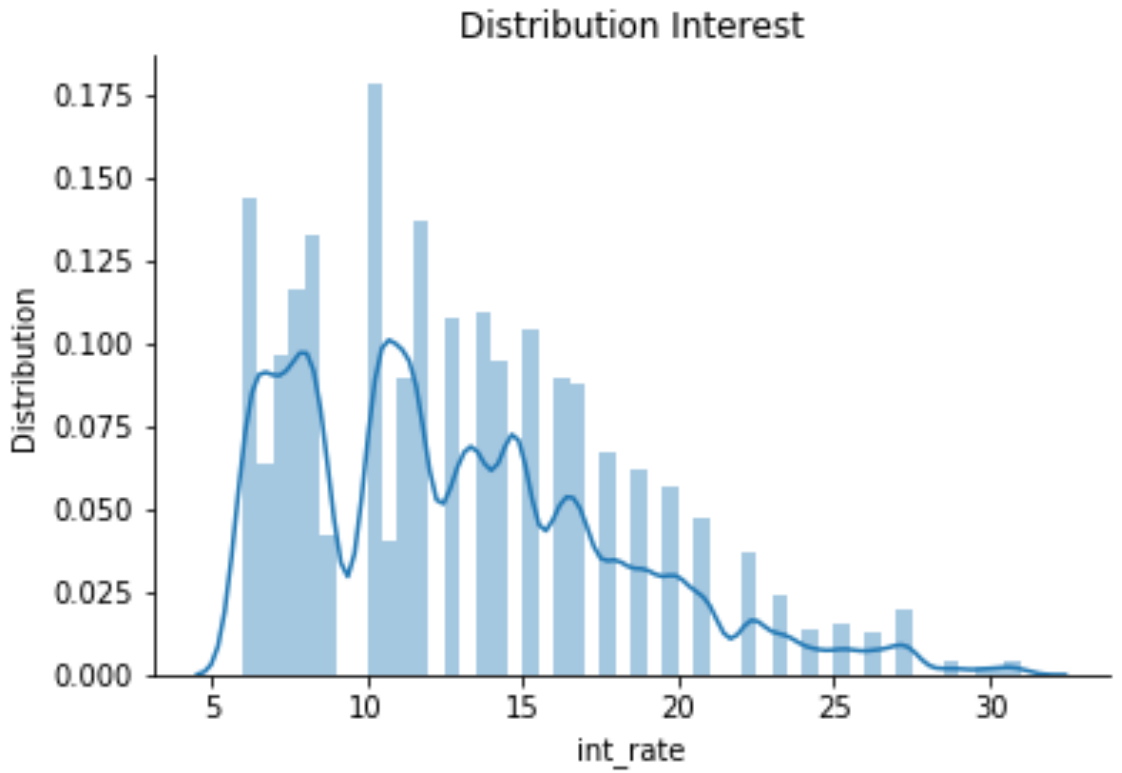


Return on Investment - Class Analysis

- Return on investment (ROI) is a ratio between net profit (over a period) and cost of investment (resulting from an investment of some resources at a point in time).

Distribution Interest

- Question: Distribution Interest?
- Why is this question relevant?



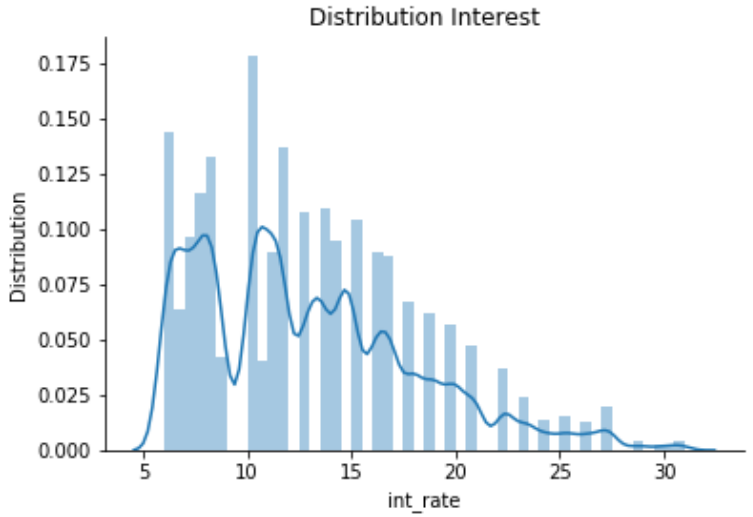
Upgrade Plot

fig : Figure

ax : axes.Axes object or array of Axes objects.

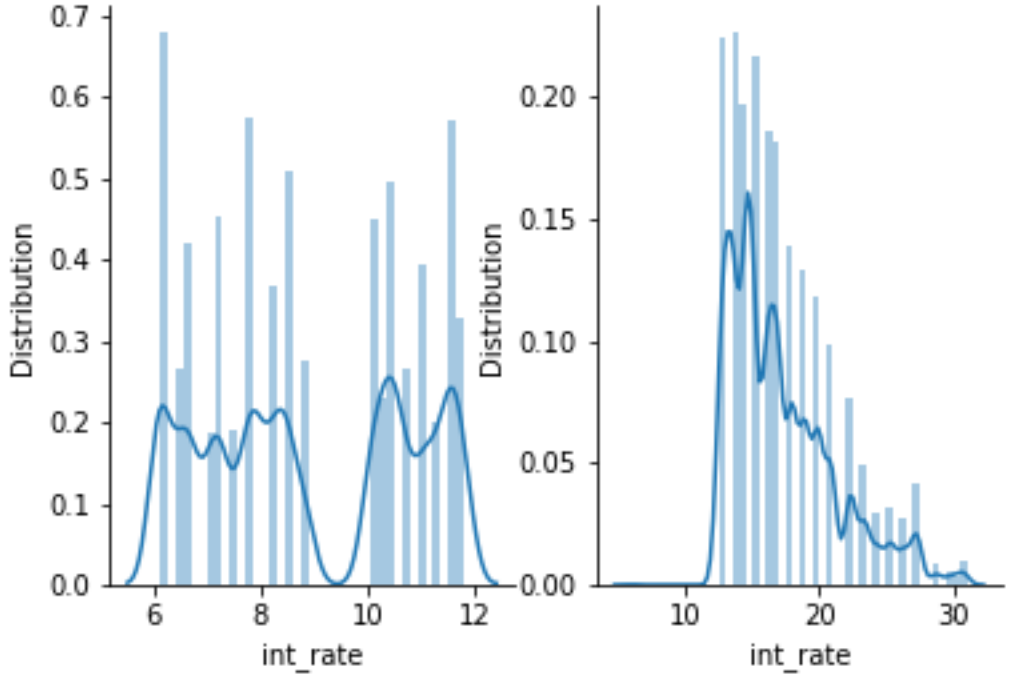
Create a figure and a set of subplots.

```
fig, ax = plt.subplots()
sns.distplot(df['int_rate'])
plt.title('Distribution Interest')
plt.xlabel('int_rate')
plt.ylabel('Distribution')
ax.spines['right'].set_visible(False)
ax.spines['top'].set_visible(False)
plt.savefig('figures/Distplot.png')
plt.show()
```



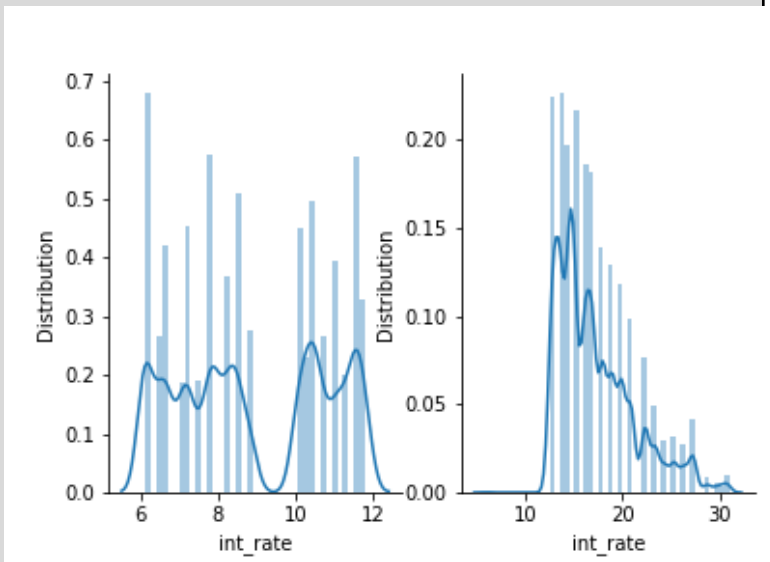
Distribution Interest divided in two classes

- Lets take a deeper look!
- Using the cut method from DataFrame to create two classes of interest with the threshold of median



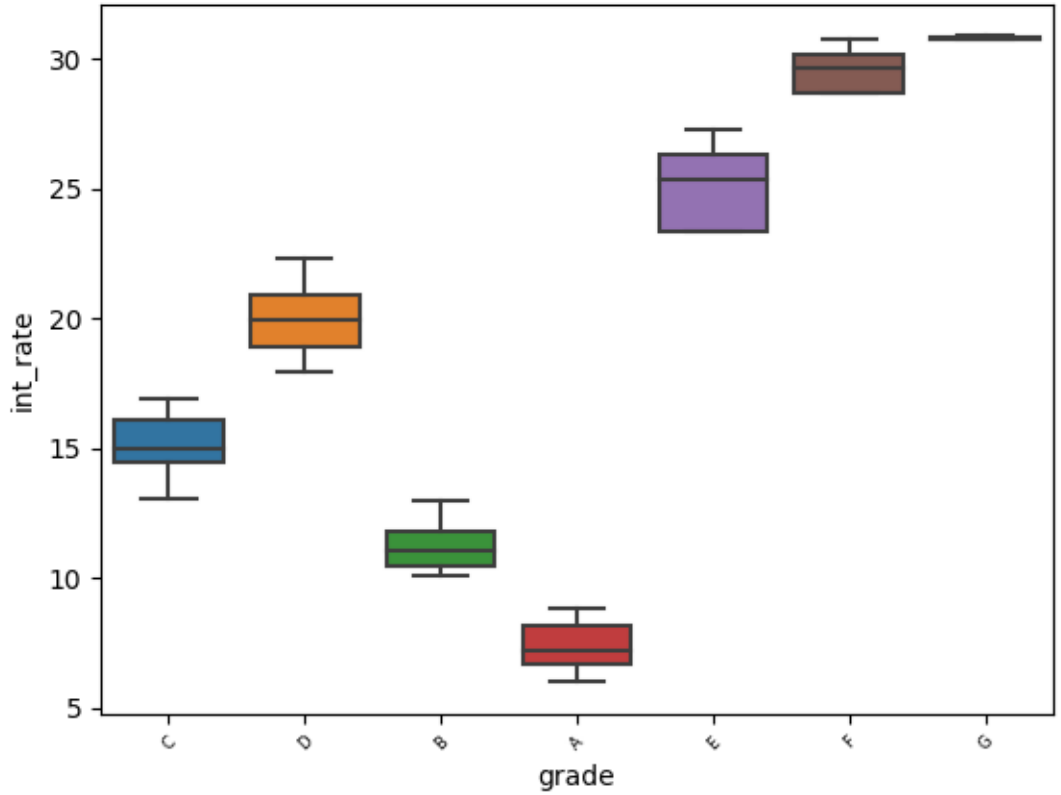
Distribution Interest divided in two classes

```
fig, ax = plt.subplots(1, 2)
sns.distplot( df['int_rate'][df['IntRateLH']=='lower'], ax=ax[0])
sns.distplot( df['int_rate'][df['IntRateLH']!='lower'], ax=ax[1])
ax[0].spines['right'].set_visible(False)
ax[0].spines['top'].set_visible(False)
ax[1].spines['right'].set_visible(False)
ax[1].spines['top'].set_visible(False)
ax[0].set_ylabel('Distribution')
ax[1].set_ylabel('Distribution')
plt.savefig('figures/SubPlotDistplot.png')
```



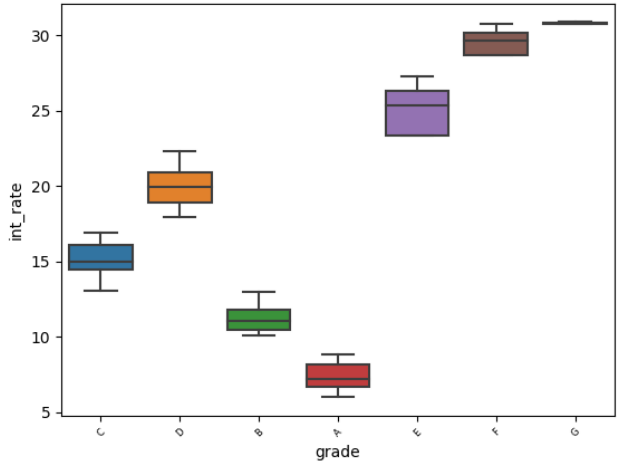
Ask an interesting question.

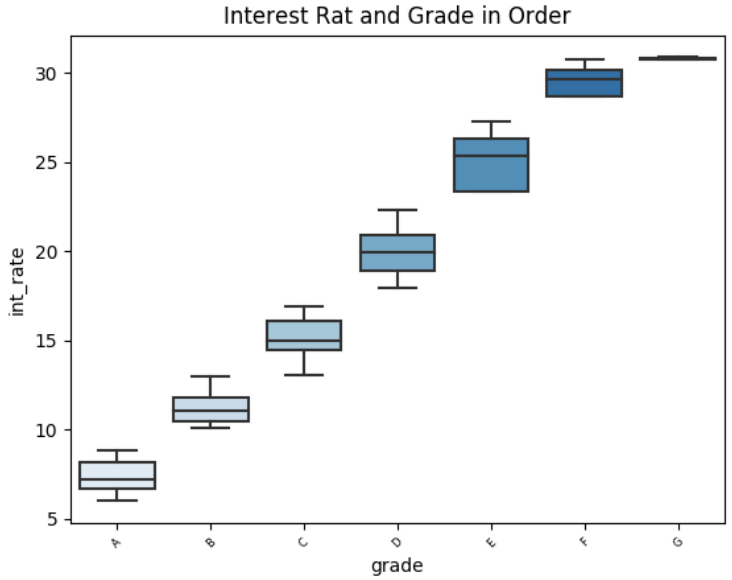
- Question: interest rate by class?
- Why is this question relevant?
- Why could be a boxplot useful?



Upgrade Plot

```
plt.figure()
sns.boxplot(x='grade', y='int_rate',
data=df, showfliers=False,
                order=['A', 'B', 'C', 'D',
'E', 'F', 'G'])
plt.xticks(rotation=45, fontsize=6)
plt.title('Interest Rat and Grades in
Order')
plt.savefig('figures/GradesIntRateOrder.
png')
plt.show()
```



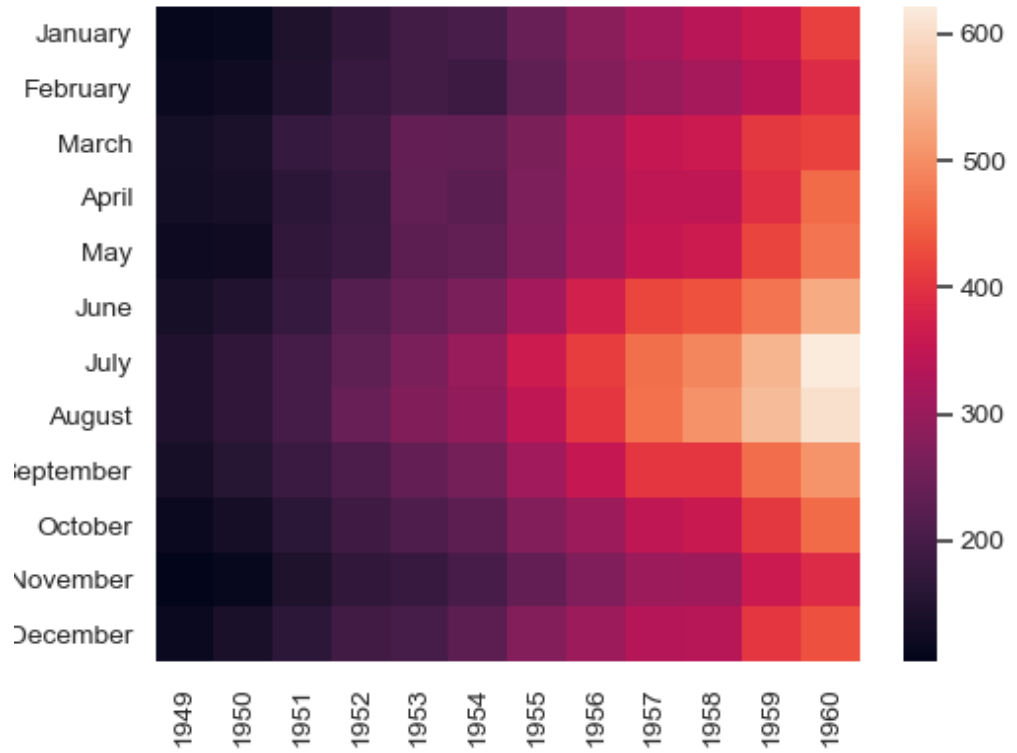


Other factors

7/29/2019

Show Heatmap

- A heatmap is a graphical representation of data where the individual values contained in a **matrix are represented as colours.**



Show Correlation with Heatmap

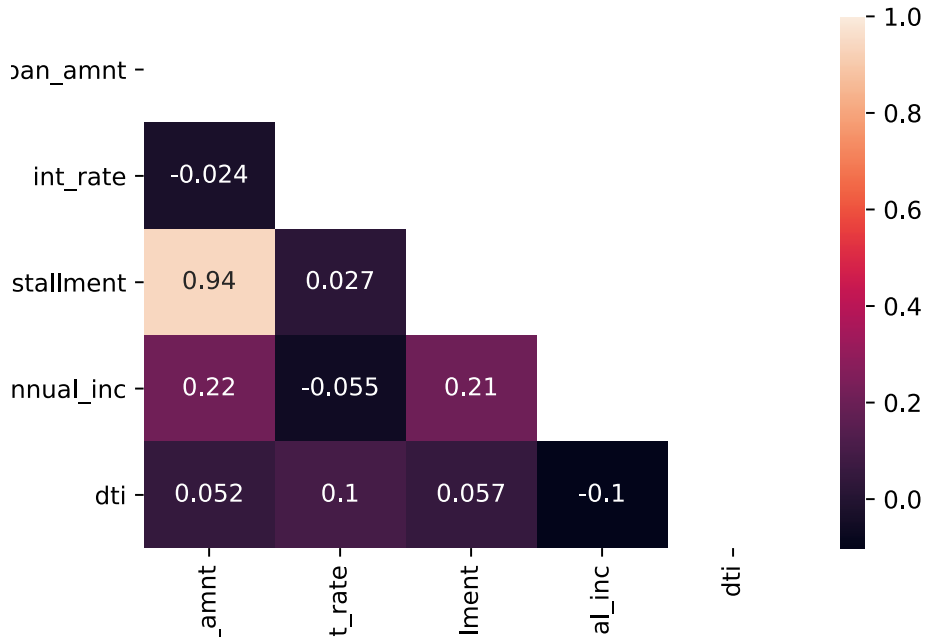
- **Correlation:**

is any statistical association, though it commonly refers to the degree to which a pair of variables are linearly related.

- **Calculation:**

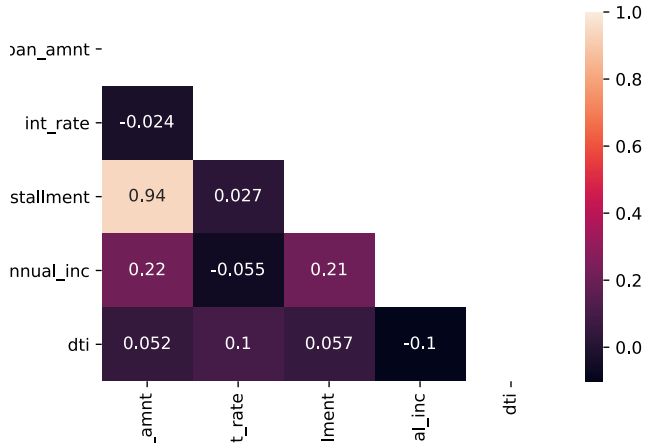
$$r_{xy} := \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2 \cdot \sum_{i=1}^{n}(y_i - \overline{y})^2}}$$

$r_{x,y}$ = has a value between +1 and −1



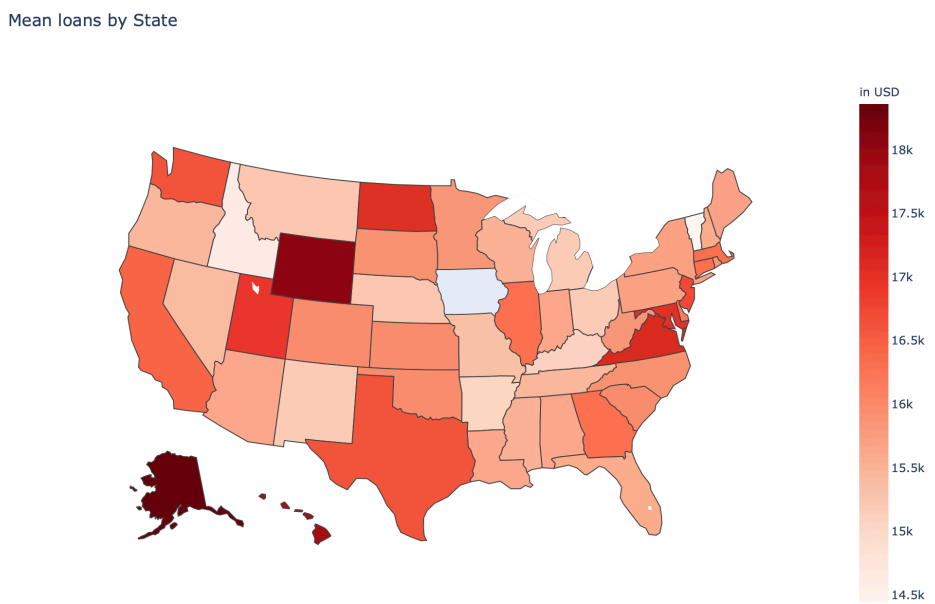
Upgrade Plot

```
plt.figure()
mask = np.zeros_like(corr,
dtype=np.bool)
mask[np.triu_indices_from(mask)] = True
sns.heatmap(corr,
        xticklabels=corr.columns,
        yticklabels=corr.columns,
annot=True, mask=mask)
plt.savefig('CoreHeatmapUpdate.pdf')
plt.show()
```



Ask an interesting question.

- Question: Mean of loan and zip code
- Why is this question relevant?
- Cloroplot (Choropleth map, in ger: Flächenkartogramm)
- Cloroplot:
- is a thematic map in which areas are shaded or patterned in proportion to the measurement of the statistical variable being displayed on the ma




```
Alternativ: For Linux for mac user:
$ conda install -c plotly plotly
```

https://anaconda.org/plotly/plotly

Ask an interesting question.

- Question: mean of loan and zip code
- Why is this question relevant?

```
state_mean =
pd.DataFrame(df.groupby('addr_stat
e')['loan_amnt'].mean())
from plotly.offline import plot
import plotly.graph_objects as go
```