Projeto #2 de IA: Regressão Linear, Clusterização, Redes Neurais

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# Introdução

Este documento tem como objetivo demonstrar a elaboração de dois sistemas de Inteligência Artificial, sendo eles um Sistema Especialista voltado a tomada de decisão em investir em criptomoedas e o outro uma Árvore de Decisão voltada para a tomada de decisão de jogar futebol ou não, com base nas condições climáticas. Sistemas especialistas são programas que têm como objetivo simular o raciocínio de um profissional “expert” em alguma área de conhecimento bem específica. Já uma Árvore de Decisão é uma abordagem comportamental que usa diagramas para mapear as várias alternativas e resultados de decisões de investimento, assim como as probabilidades de ocorrerem.

Com este trabalho, o principal foco é demonstrar como sistemas de IA podem ajudar os usuários a tomarem decisões em assuntos do seu cotidiano. Com a expansão do mercado de moedas virtuais, surgiu a ideia de criar um sistema para auxiliar o investidor em decidir se deve ou não investir em determinada criptomoeda baseado em algumas variáveis de mercado e uma árvore de decisão para concluir se é recomendado jogar futebol com base nas condições climáticas atuais.

# Sistema Especialista

* 1. **Introdução**

a) Breve descrição do contexto do problema:

Criptomoedas se tornaram grandes atrações para se investir dinheiro, tanto para investidores reais, entusiastas de tecnologia ou até mesmo para pessoas comuns. O foco do projeto desenvolvido é que ele possa te mostrar através de algumas regras definidas no código, se pode ser válido e lucrativo o investimento em determinadas criptomoedas. Isso tudo, levando em consideração determinadas variavéis relacionadas a valores das moedas.

b) Variáveis do problema (nomes, tipos, domínio de valores):

investValue = Valor a ser investido.

coin = Nome da moeda a ser analisada.

state = Verifica se a moeda é valida.

percentChange1h = Porcentagem de mudança na ultima hora.

percentChange24h = Porcentagem de mudança nas ultimas 24 horas.

percentChange7d = Porcentagem de mudança nos ultimos 7 dias.

c) Dentre as variáveis, qual é a Variável Objetivo (Classe);

A variável Objetivo é a classe Coin, pois ela contém o model de uma criptomoeda. Assim sendo, nas variáveis dentro da classe será guardada informações as quais serão posteriormente utilizadas para análise e utilização dos dados.

# Clustering com K-Means

* 1. **Planejamento**

1. **Breve descrição do contexto do problema.**

Algo muito praticado por fãs de modalidades esportivas é o acompanhamento dos resultados obtidos pelos jogadores durante a temporada. Com isso foi decidido buscar uma forma de agrupar os jogadores eleitos o Melhor Jogador da Semana na NBA de acordo com determinados status de interesse no momento. Para isso foi utilizada uma base de dados contendo os jogadores eleitos desde a temporada 1984-85 até a temporada 2017-2018.

1. **Por que está usando Clustering para o Problema.**

Clustering é o conjunto de técnicas de prospeção de dados (data mining) que visa fazer agrupamentos automáticos de dados segundo o seu grau de semelhança. O que se enquadra perfeitamente na proposta de agrupar perfis de jogadores de acordo com um status de interesse em comum.

1. **Variáveis do problema (nomes, tipos, domínio de valores).**

Name: String - Nome dos jogadores

Games Played: Inteiro - Quantidade de jogos realizados na temporada

PTS: Inteiro - Quantidade de pontos marcados durante a temporada

FGM: Inteiro - Quantidade de cestas (não lance livre) convertidas

3P%: Inteiro - Porcentagem de arremessos de 3 pontos convertidos

FT%: Inteiro - Porcentagem de lances livres convertidos

REB: Inteiro - Quantidade de rebotes executados na temporada

AST: Inteiro - Quantidade de assistências executadas na temporada

STL: Inteiro - Quantidade de roubadas de bola executadas na temporada

PF: Inteiro - Quantidade de faltas pessoais cometidas durante a temporada

# Implementação

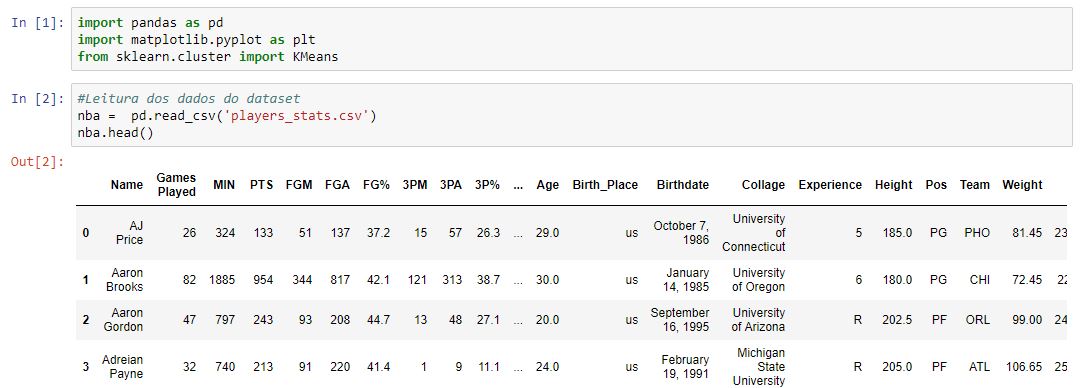
# O conjunto de dados obtidos originalmente pelo link <https://www.kaggle.com/jacobbaruch/nba-player-of-the-week> possuía atletas com dados faltantes, para resolver este problema os dados foram tratados por um algoritmo em python para remover os dados defeituosos gerando o arquivo “players\_stats\_new.xls”.

**Figura 1 – Algoritmo de tratamento dos dados ![Uma imagem contendo captura de tela

Descrição gerada automaticamente](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4REoRXhpZgAATU0AKgAAAAgABAE7AAIAAAAfAAAISodpAAQAAAABAAAIapydAAEAAAA+AAAQ4uocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFRpYWdvIGhlbnJpcXVlIGRhIGNydXogcGVyZWlyYQAAAAWQAwACAAAAFAAAELiQBAACAAAAFAAAEMySkQACAAAAAzg5AACSkgACAAAAAzg5AADqHAAHAAAIDAAACKwAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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ADKxXPTvxkZqa30o29ibVb+7ZMrsYlAyYOeCqjr3zmlTSYxFOJZ5ppJipaZtqsCvKkbQBweelZ2xFlbt5bmv+z3d+/S+wumavbaqkhtmG6PG9BIj4znHKMR2PemaBrH9vaLDqP8AZ1/pvmlh9l1GDyZk2sV+ZcnGcZHsRVq2gkgRhLdzXJPRpQgI/wC+VFVdA0f+wdFh07+0b/UvKLH7VqM/nTPuYt8zYGcZwPYCumnzcnv7nPU5eZ8m39eho0UUVZmFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQBT1XU4NI057u5WRwGVEjiXLyuzBURR6liAMkDnkgc1gv4+s7S31CbWNMv8ASE06OJp2vnt0UNI21EDCUrk8fNnYM8sMHG3rWnDVNImtsZk4khYSbCkqENGwbDYwwU52sOOQRwee0LwnqT2Opf8ACV3bTXV80R3xXXmvGYjlHEgiiAYNggLGoG3vk0u/9f1/ww9NCXRPiFpfiHSb+70iGS7nsEDzWVvdWs0u0524aOZoudrcFweOcZGbVh4viv8ARLjVv7J1K1sooBcRyXiRw+emMkqGcFcf7e31GRzUy6BenSLqxn8T6tO9wAounjtRLEM8hQsATkcfMp9sHmqy+DVbwu2h32talfQgxGCadbcSW/llSm3ZEqtgqD86tnvmm+vy/wCD+gl0/rt/wSLR/iBpGt6HPqVkkr+RMsBt4pYZ3eRiAiq8Ujxkkkfx8fxYwajsPF902p6umr6fPYx2qWpgs5IV+0b5mdAhZJXjfcyLgqQBuw3QmrUHg2KNbw3OsapdzXZidppniDxyxnKyptjAU9OMbOPu8nLIPBMa3V1c3ut6rfz3UUSSPcNCuGicvFIoSNQrKSeB8p/iUnmj1/r/AIP/AAPMDS0nWzqcstvc6deaXeRKsjWt4Yi+xiQGBid1IJUj72RjkDIzJrWrjRbOK4Nlc3gkuIrfZbbMqZGCKx3soxkgHnPPSo9J0Q6bJLPc6leapeSqsbXV4Ig4RSSFAjRFABYn7uTnknAxWtvCsUPg9vD8+q6peoyuPt15cCW6BLFg28rjKkjbkcbR6UMCL/hMbaa4vE0uxudUitbQXQubKW3eKcFmXYjGUfNlH+9tHyHmpdK8TtrOly39noWrLEIVmt1njjia7BGcIGcbT2+fYOcgkc1DaeCbHTNP1G10e7u9O+3iNTLD5bNCqKF2oHRlwcMTkHl2IxkYnsPDl1p+gNpcXiTVXICrDdyR2vm26rgBVxCEIwMfMrHk80aa/wBd7/oHb+u3/BKq+Kp0+HkniQadPeyxQSStaRiOFzsJBBzIyjGDnDt0OM8CppPFsdh4dudY1/TLrRILcqNt9NbAyFiAuGSVkAJIGWZcdTgc03SPCCaZod3pFzrGo6nZXMTxeXdiBTGr7t+0xRIedx65xgYxT7fwmi6fdWuoaxqupNceXie5mVWhMZyhjWNVRSGwdwXJIGScCh7Matp/X9dSnonxC0vxDpN/d6RDJdz2CB5rK3urWaXac7cNHM0XO1uC4PHOMjNmx8YwX2ktqTaVqlrasIvszXMCo10ZCAqom4sDuIHzheuenNTroF6dIurGfxPq073ACi6eO1EsQzyFCwBORx8yn2weaZY+FhbaD/ZV5q+oajEhjMEtwIVkt/LwU2mKNBwVB+YHPfI4p6a/L/gi7fP/AIH6kMnjLyIP9L0HVbe6E0MbWbm3MirK+xJNyylCu4YOGLD05q5p3ia01bWpbHT43uIY7dbgahDLFJbyAsybVKuW3bkccqB8p5qv/wAIlHLp17b6hquoX9zeRCJr6byVmjVSWTYEjVAVYlgduc4znAqxoHhfTvDb3Z0xZFW6MeUYghAiBQq8cDq3OeWY96NAfkQWPiGe60rVtUWye5t7W6mhtoLbaJZVhby3OXcLnesmORwB3plj4xgvtJbUm0rVLW1YRfZmuYFRroyEBVRNxYHcQPnC9c9OaW08OXNvpOq6WmoSWdvdXcs9tcWoQyxLK3mOuJEZfvtIOh+UjoafY+FhbaD/AGVeavqGoxIYzBLcCFZLfy8FNpijQcFQfmBz3yOKS8/L/g/P8NxvfTu/+B/W5DJ4y8iD/S9B1W3uhNDG1m5tzIqyvsSTcspQruGDhiw9OaVvG2nebfmGKa5srKy+2Nf2zxSwSLuZdqlXLbso4OQANpyeKf8A8IlHLp17b6hquoX9zeRCJr6byVmjVSWTYEjVAVYlgduc4znApln4I07TbK+ttKub2xF40JMlvKFeERhQFQ44BwSQc5Lt60dP6/rzDT+v6/pEOgeNE8YaXqEnh23MVxbxjypLiSGeBpGDbV3wSupxtG4BsgMPWtrQ9Wi13QbHVLdWSO8gWUI3VcjJB9weKz7Lw9Po9vqdzZ38upaveRgC61ERpkoG8tW8mNRtBYnhc8mtDQ9Ji0LQbHS7dmeOzgWIO3VsDBJ9yeaemvy/W4i/RRRSAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigD/9k=)**

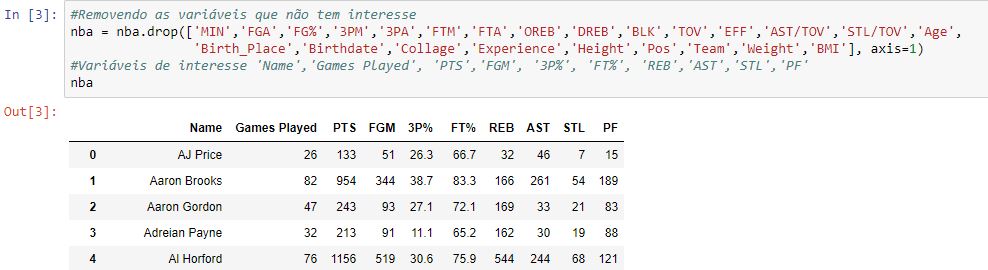
Após tratar os dados o próximo passo é importar as bibliotecas que serão utilizadas e ler a base de dados na forma de um DataFrame chamado ‘nba’.

**Figura 2 – Importação de Bibliotecas e Leitura dos Dados**

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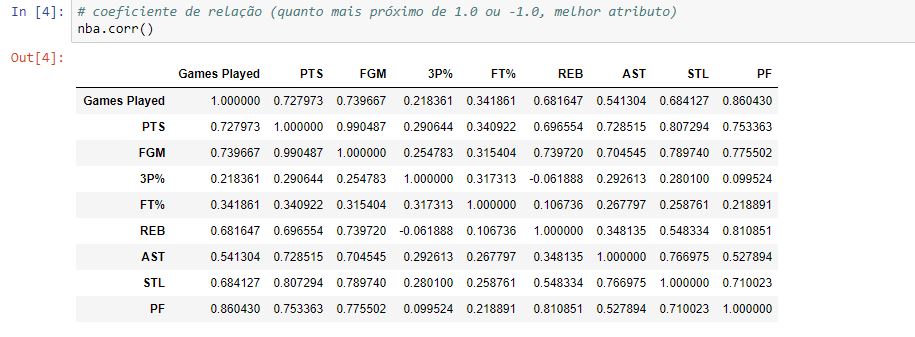
Com o DataFrame em mãos é preciso dar uma limpada nos dados que não tem funcionalidade para o projeto em questão, assim são retiradas as variáveis “lixo” deixando apenas as varáveis de interesse.

**Figura 3 – Variáveis de Interesse**

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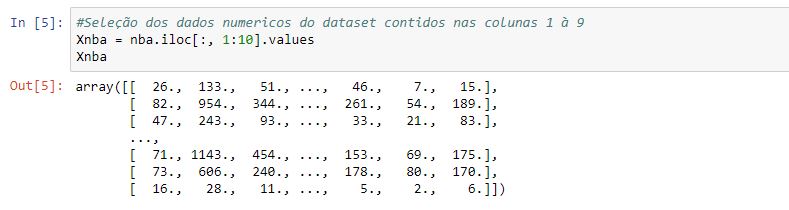
Com o DataFrame devidamente configurado é calculado o coeficiente de correlação entre as variáveis para saber quais variáveis se relacionam melhor entre si.

**Figura 4 – Coeficiente de Correlação**

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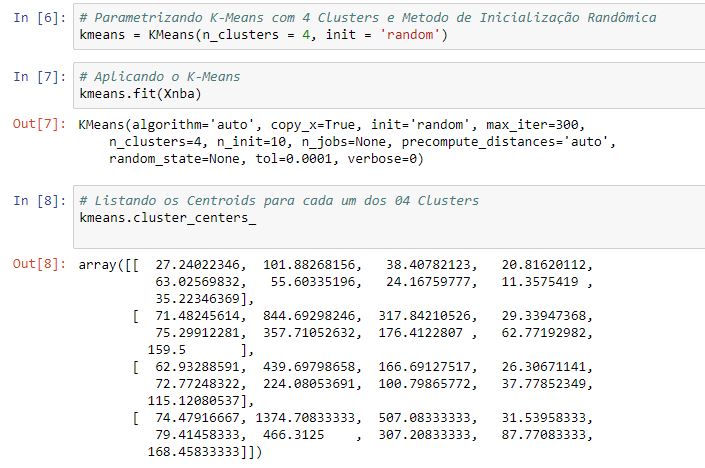
Para realizar a clusterização dos dados, tem se que utilizar apenas os dados numéricos da base de dados. Para isso é feito uma seleção das colunas que se enquadram nesse quesito dentro do DataFrame ‘Xnba’.

**Figura 5 – Seleção dos Dados Numéricos**

****

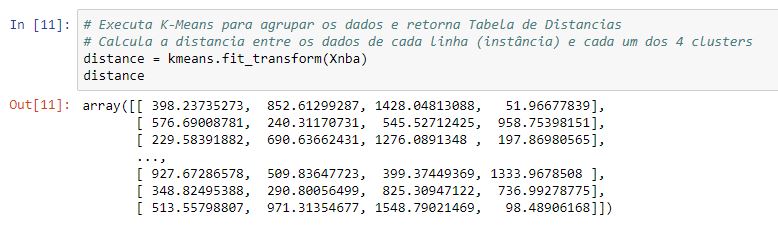
Agora finalmente é iniciada a clusterização em si, primeiramente precisa setar a quantidade de clusters que serão utilizados e qual o método de inicialização, após isso é aplicado o kmeans ao ‘Xnba’ para realizar a clusterização e é exibido os centroides do clusters.

**Figura 6 – Clusterização**

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# Em seguida é calculada a distância entre os dados de cada linha do DataFrame (instância) e cada um dos 4 clusters criados.

**Figura 7 – Calculo da Distância das Instâncias aos Centroides**

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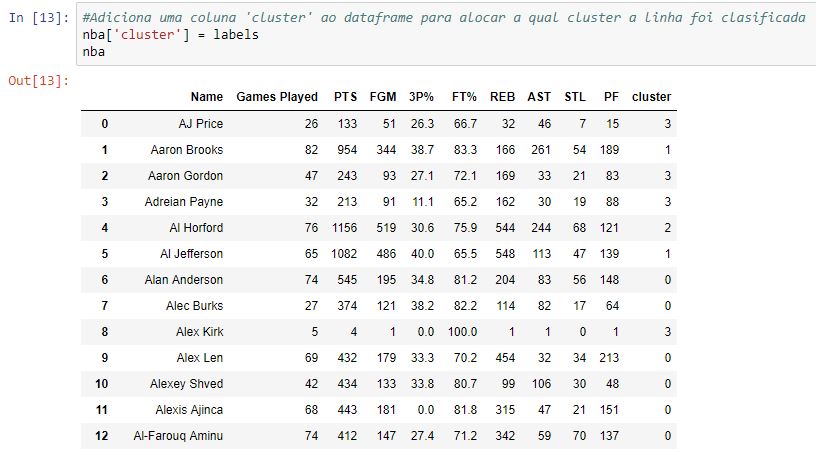
# Na variável ‘labels’ é guardada a numeração do cluster em que cada instância foi alocada.

**Figura 8 – Cluster em que a Instância se Encontra**

# 

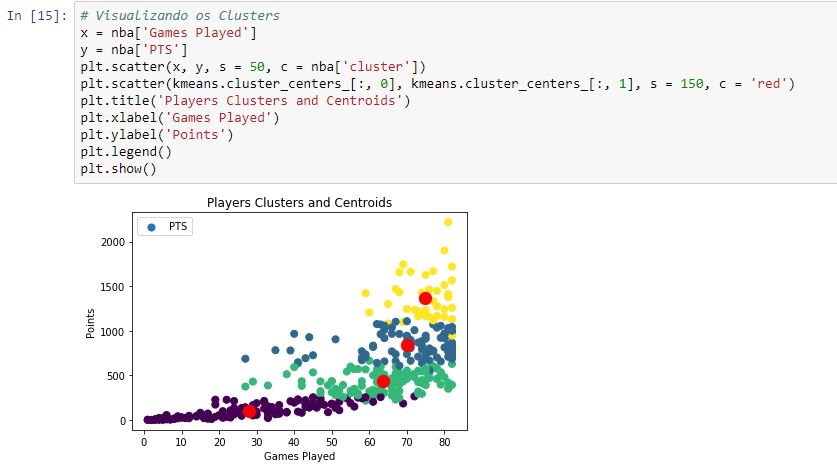
# Para facilitar na exibição visual da clusterização é necessário adicionar uma nova coluna ao DataFrame ‘nba’ uma coluna ‘cluster’ para receber o valor de qual cluster a instância foi classificada.

**Figura 9 – DataFrame com a Coluna ‘cluster’**

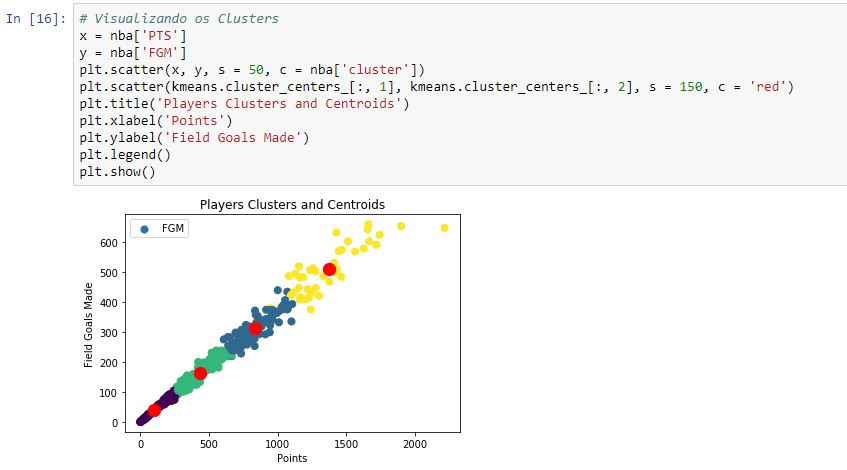
****

# Com todos os passos realizados falta a visualização dessa clusterização, para isso foram escolhidas duas tuplas de variáveis com o valor de suas correlações próximos de 1,00. Que foram Jogos Realizados x Pontos Marcados e Pontos Marcados x Arremessos de 2 e 3 Pontos Convertidos.

**Figura 10 – Gráfico Jogos Realizados x Pontos Marcados**

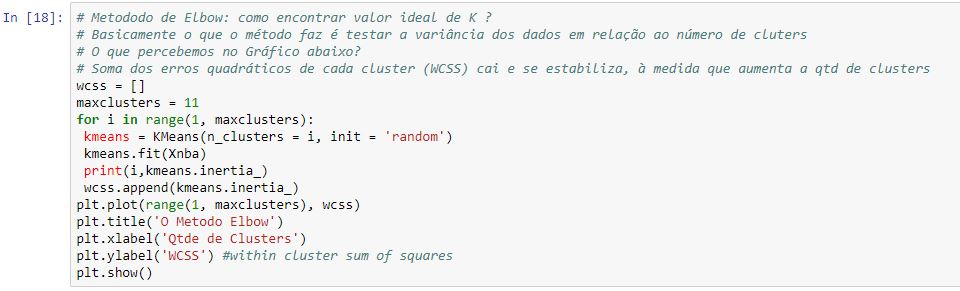
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**Figura 11 – Gráfico Pontos Marcados x Arremessos de 2 e 3 Pontos Convertidos**

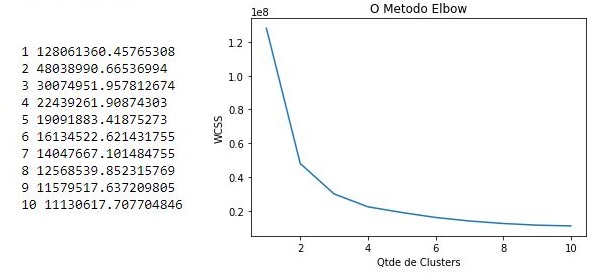
****

# Ao término da clusterização foi executado o método Elbow para determinar a quantidade ideal de clusteres para serem utilizados para uma otimização dos resultados com essa base de dados.

# Figura 12 – Método Elbow



**Figura 13 – Gráfico Elbow**

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# 3.3 Validação e Testes

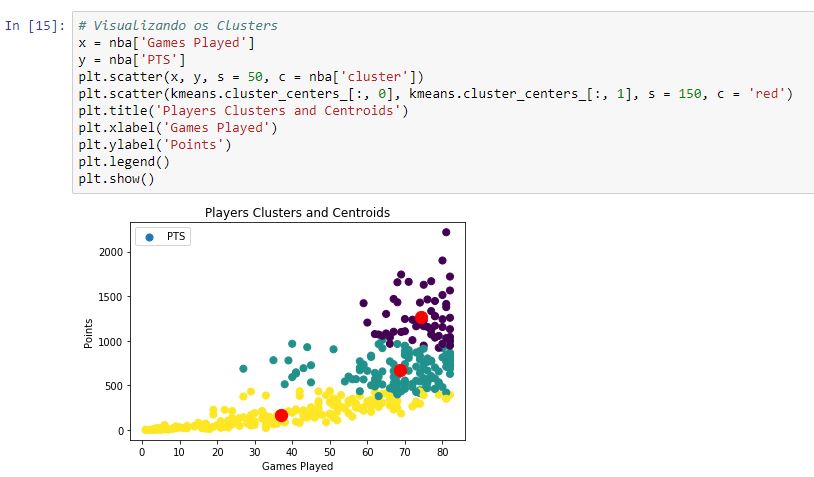
Analisando o gráfico Elbow pode-se concluir que a quantidade ideal de clusters para essa base de dados é 3 clusters. Sendo assim o código foi compilado novamente dessa vez com 3 clusters.

**Figura 14 – Kmeans Iniciado com 3 Clusters**

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Agora com 3 clusters percebe-se uma melhor unidade nas tuplas selecionadas anteriormente.

**Figura 15 – Gráfico Jogos Realizados x Pontos Marcados**

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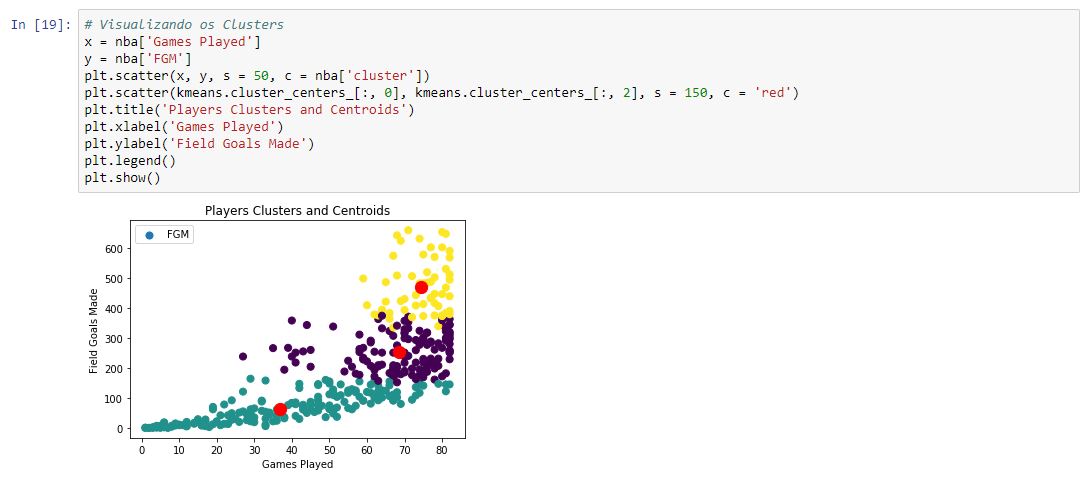
**Figura 16 – Gráfico Pontos Marcados x Arremessos de 2 e 3 Pontos Convertidos**

# 

Para verificar como o coeficiente de correlação afeta na clusterização foi rodado alguns testes com outras tuplas de dados da base. Que serão mostrados a seguir.

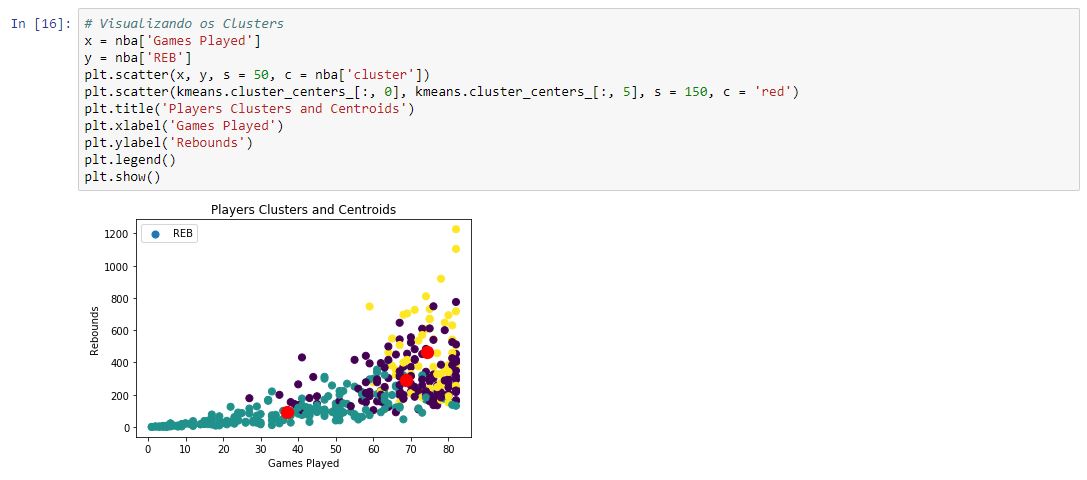
Uma tupla com um bom coeficiente é a tupla Jogos Realizados x Arremessos de 2 e 3 Pontos Convertidos, o que corrobora com o fato de quanto melhor o o coeficiente melhor a clusterização.

**Figura 17 - Gráfico** **Jogos Realizados x Arremessos de 2 e 3 Pontos Convertidos**

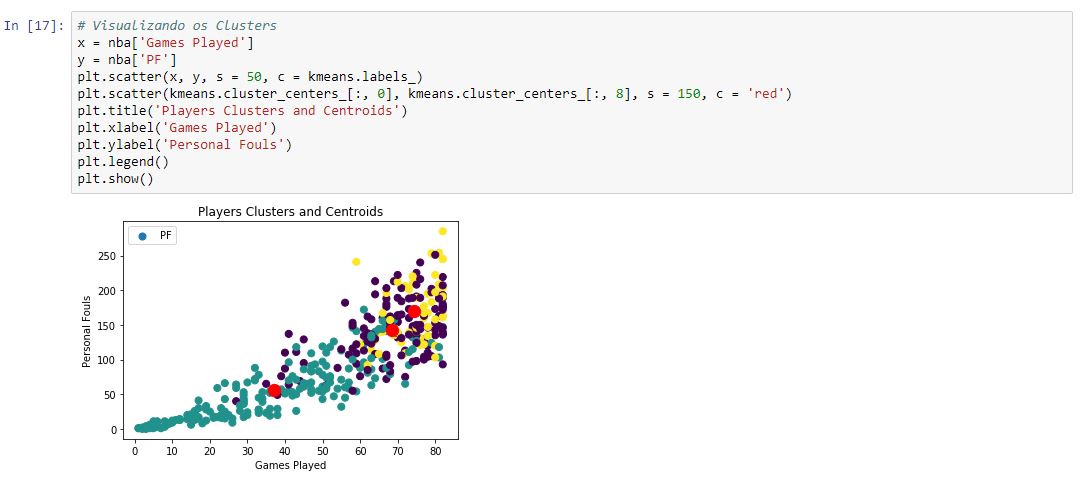


E o contrário também é comprovado ao se escolher tuplas com um coeficiente de correlação baixo reproduzem uma clusterização precária.

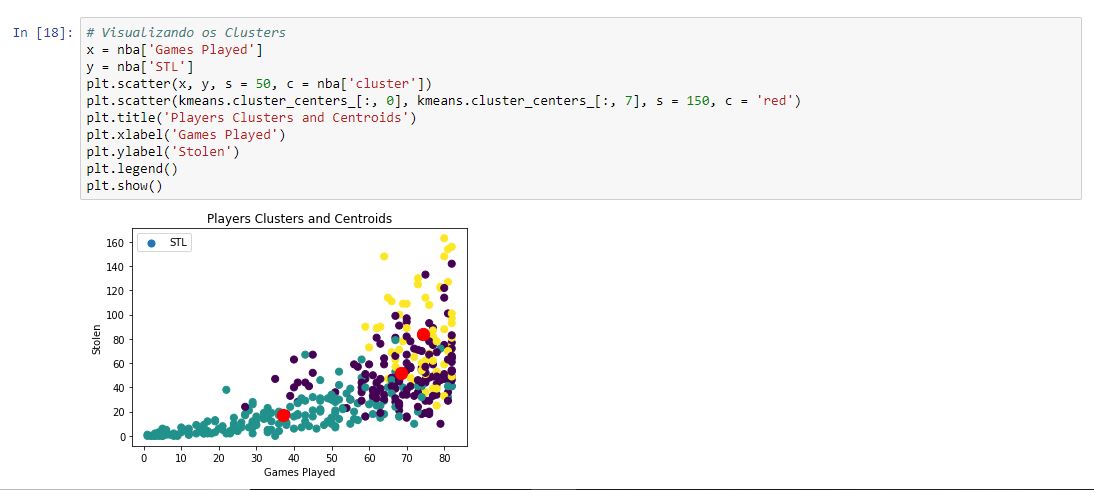
**Figura 18 - Gráfico Jogos Realizados x Rebotes**



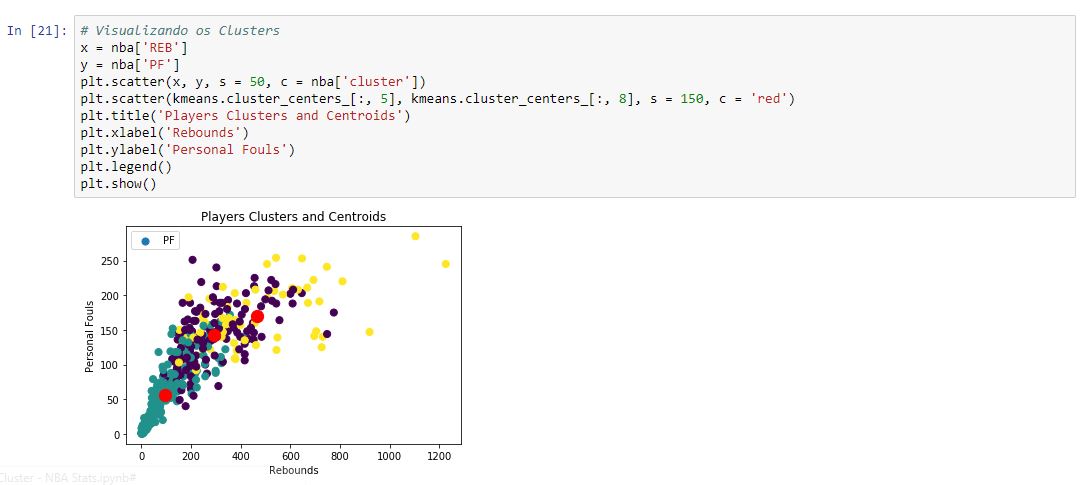
**Figura 19 - Gráfico Jogos Realizados x Faltas Pessoais Cometidas**



**Figura 20 - Gráfico Jogos Realizados x Roubadas de Bola**

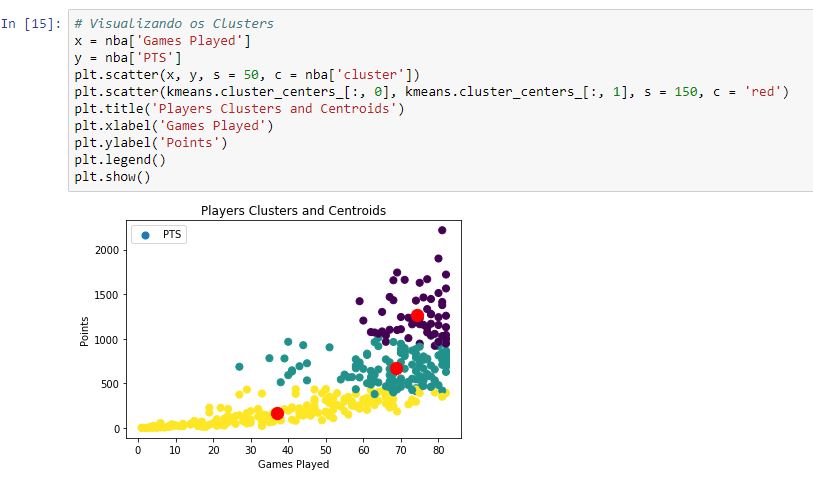


**Figura 21 - Gráfico Rebotes x Faltas Pessoais Cometidas**

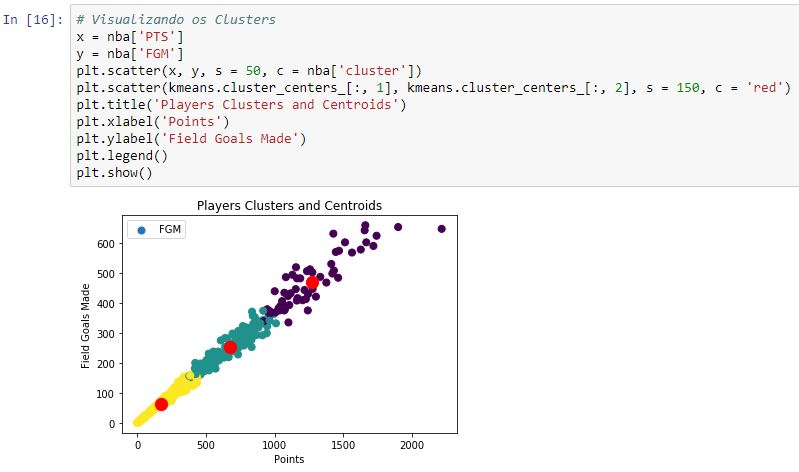


Há a possibilidade de alterar a inicialização do kmeans do método randômico para o método kmeans++ para testar se há mudanças na geração dos grupos. Porém como pode ser visto nas próximas imagens, não houve mudanças relevantes em nenhum dos testes.

**Figura 22 – Gráfico Jogos Realizados x Pontos Marcados – kmeans++**

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**Figura 23 – Gráfico Pontos Marcados x Arremessos de 2 e 3 Pontos – kmeans++**



# 3.4. Sobre Conceitos

1. Explicar a aplicação do conceito de Elbow para a determinação do valor de K (quantidade de grupos).

O Método Elbow é utilizado para a determinação da quantidade de grupos em que as instâncias serão agrupados pelo kmeans. O método consistem em ir acrescentando 1 cluster a cada iteração. No gráfico que o algoritmo gera, a quantidade ótima K é determinada no ponto em que há a distância entre as quantidades de clusters passa a ser quase insignificante, formando uma quebra abrupta na linha do gráfico, assemelhando-se a um cotovelo (Elbow) em um braço.

**Figura 24 – Gráfico Elbow**

**![Uma imagem contendo texto

Descrição gerada automaticamente](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RE0RXhpZgAATU0AKgAAAAgABQESAAMAAAABAAEAAAE7AAIAAAAfAAAIVodpAAQAAAABAAAIdpydAAEAAAA+AAAQ7uocAAcAAAgMAAAASgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFRpYWdvIGhlbnJpcXVlIGRhIGNydXogcGVyZWlyYQAAAAWQAwACAAAAFAAAEMSQBAACAAAAFAAAENiSkQACAAAAAzkwAACSkgACAAAAAzkwAADqHAAHAAAIDAAACLgAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAyMDE4OjExOjI2IDE1OjM2OjUyADIwMTg6MTE6MjYgMTU6MzY6NTIAAABUAGkAYQBnAG8AIABoAGUAbgByAGkAcQB1AGUAIABkAGEAIABjAHIAdQB6ACAAcABlAHIAZQBpAHIAYQAAAP/hCzFodHRwOi8vbnMuYWRvYmUuY29tL3hhcC8xLjAvADw/eHBhY2tldCBiZWdpbj0n77u/JyBpZD0nVzVNME1wQ2VoaUh6cmVTek5UY3prYzlkJz8+DQo8eDp4bXBtZXRhIHhtbG5zOng9ImFkb2JlOm5zOm1ldGEvIj48cmRmOlJERiB4bWxuczpyZGY9Imh0dHA6Ly93d3cudzMub3JnLzE5OTkvMDIvMjItcmRmLXN5bnRheC1ucyMiPjxyZGY6RGVzY3JpcHRpb24gcmRmOmFib3V0PSJ1dWlkOmZhZjViZGQ1LWJhM2QtMTFkYS1hZDMxLWQzM2Q3NTE4MmYxYiIgeG1sbnM6ZGM9Imh0dHA6Ly9wdXJsLm9yZy9kYy9lbGVtZW50cy8xLjEvIi8+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczp4bXA9Imh0dHA6Ly9ucy5hZG9iZS5jb20veGFwLzEuMC8iPjx4bXA6Q3JlYXRlRGF0ZT4yMDE4LTExLTI2VDE1OjM2OjUyLjg5NjwveG1wOkNyZWF0ZURhdGU+PC9yZGY6RGVzY3JpcHRpb24+PHJkZjpEZXNjcmlwdGlvbiByZGY6YWJvdXQ9InV1aWQ6ZmFmNWJkZDUtYmEzZC0xMWRhLWFkMzEtZDMzZDc1MTgyZjFiIiB4bWxuczpkYz0iaHR0cDovL3B1cmwub3JnL2RjL2VsZW1lbnRzLzEuMS8iPjxkYzpjcmVhdG9yPjxyZGY6U2VxIHhtbG5zOnJkZj0iaHR0cDovL3d3dy53My5vcmcvMTk5OS8wMi8yMi1yZGYtc3ludGF4LW5zIyI+PHJkZjpsaT5UaWFnbyBoZW5yaXF1ZSBkYSBjcnV6IHBlcmVpcmE8L3JkZjpsaT48L3JkZjpTZXE+DQoJCQk8L2RjOmNyZWF0b3I+PC9yZGY6RGVzY3JpcHRpb24+PC9yZGY6UkRGPjwveDp4bXBtZXRhPg0KICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAKICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgIAogICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgCiAgICAgICAgICAgICAgICAgICAgICAgICAgICA8P3hwYWNrZXQgZW5kPSd3Jz8+/9sAQwACAQECAQECAgICAgICAgMFAwMDAwMGBAQDBQcGBwcHBgcHCAkLCQgICggHBwoNCgoLDAwMDAcJDg8NDA4LDAwM/9sAQwECAgIDAwMGAwMGDAgHCAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwMDAwM/8AAEQgBFAGLAwEiAAIRAQMRAf/EAB8AAAEFAQEBAQEBAAAAAAAA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U6iigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAP//Z)**

1. Para um teste, em específico, explicar a aplicação do cálculo de médias, usando inicialização randômica.

Utilizando a inicialização randômica o kmeans irá inserir o K centroides de forma aleatória. No funcionamento do algoritmo em sua primeira iteração ele irá calcular a distância média dos pontos em relação aos centroides. Feito isso os centroides mudam de posição indo para o ponto em que é a distância média de todos os pontos que se ligaram a ele. Com essa mudança de posição alguns pontos irão mudar de centroide, com isso este passo é repetido em loop até que no final nenhum ponto mude de centroide. O que significa que os centroides já estão na posição correta.

# Conclusão

Através da Inteligência Artificial se torna possível fazer com que maquinas aprendam com suas experiências, que possam se ajustar e utilizar novas entradas de dados e possam realizar tarefas tais como seres humanos. Utilizando de determinadas tecnologias é possivel que computadores cumpram especificas tarefas ao processar determinada quantidade de dados, reconhecer e utilizar padrões desses mesmos dados.

Podemos utilizar diversos modelos para tal fim, mas temos como foco a utilzação das Árvores de Decisão, que nada mais são que um conjunto de treinamento que se utiliza de entradas e saidas para a classificação e a previsão de dados.

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