BurnOut Lite - AI Based CPU Benchmarking Tool

Benchmarks Dataset

In [42]:

```python
import pandas as pd

# Loading the uploaded Cinebench R23 dataset
benchmarks = pd.read_csv('CPU_benchmark_v4.csv')

# Showing basic info
benchmarks.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3825 entries, 0 to 3824
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   cpuName      3825 non-null   object 
 1   price        1967 non-null   float64
 2   cpuMark      3825 non-null   int64  
 3   cpuValue     1967 non-null   float64
 4   threadMark   3825 non-null   int64  
 5   threadValue  1967 non-null   float64
 6   TDP          3140 non-null   float64
 7   powerPerf    3140 non-null   object 
 8   cores        3825 non-null   int64  
 9   testDate     3825 non-null   int64  
 10  socket       3825 non-null   object 
 11  category     3825 non-null   object 
dtypes: float64(4), int64(4), object(4)
memory usage: 358.7+ KB
```

In [43]:

```python
# Description of the dataset
round(benchmarks.describe())
```

Out[43]:

	price	cpuMark	cpuValue	threadMark	threadValue	TDP	cores	testDate
count	1967.0	3825.0	1967.0	3825.0	1967.0	3140.0	3825.0	3825.0
mean	442.0	5992.0	35.0	1391.0	15.0	62.0	5.0	2015.0
std	907.0	9618.0	36.0	816.0	18.0	48.0	6.0	5.0
min	4.0	77.0	0.0	75.0	0.0	2.0	1.0	2007.0
25%	65.0	943.0	12.0	729.0	5.0	28.0	2.0	2011.0
50%	161.0	2331.0	26.0	1274.0	10.0	53.0	4.0	2015.0
75%	393.0	6643.0	46.0	1961.0	19.0	85.0	6.0	2020.0
max	8978.0	108822.0	345.0	4317.0	268.0	300.0	80.0	2022.0

In [44]:
```
# Top 5 rows
benchmarks.head()
```

Out[44]:

	cpuName	price	cpuMark	cpuValue	threadMark	threadValue	TDP	powerPe
0	AMD Ryzen Threadripper PRO 5995WX	NaN	108822	NaN	3330	NaN	280.0	388.6
1	AMD EPYC 7763	7299.99	88338	12.10	2635	0.36	280.0	315.4
2	AMD EPYC 7J13	NaN	86006	NaN	2387	NaN	NaN	Na
3	AMD EPYC 7713	7060.00	85861	12.16	2727	0.39	225.0	381
4	AMD Ryzen Threadripper PRO 3995WX	6807.98	83971	12.33	2626	0.39	280.0	299

In [45]:
```
# Bottom 5 rows
benchmarks.tail()
```

Out[45]:

	cpuName	price	cpuMark	cpuValue	threadMark	threadValue	TDP	powerPerf
3820	Intel Pentium 4 1.60GHz	NaN	84	NaN	225	NaN	38.0	2.22
3821	Intel Pentium 4 1400MHz	NaN	83	NaN	180	NaN	54.7	1.52
3822	Intel Pentium 4 1500MHz	NaN	81	NaN	223	NaN	57.8	1.41
3823	VIA Eden 1000MHz	NaN	80	NaN	83	NaN	5.0	16.08
3824	Intel Pentium 4 1300MHz	NaN	77	NaN	203	NaN	51.6	1.5

In [46]:
```
# Dataset Columns
benchmarks.columns
```

Out[46]:
```
Index(['cpuName', 'price', 'cpuMark', 'cpuValue', 'threadMark', 'threadValue',
       'TDP', 'powerPerf', 'cores', 'testDate', 'socket', 'category'],
      dtype='object')
```

Dataset Cleaning

In [47]:

```
# Dropping the columns that won't be useful or are post-benchmark calculations
columns = ['price', 'cpuValue', 'threadValue']
cleanedBenchmarks = benchmarks.drop(columns = columns)
```

In [48]:

```
cleanedBenchmarks.head(3)
```

Out[48]:

	cpuName	cpuMark	threadMark	TDP	powerPerf	cores	testDate	socket	ca
0	AMD Ryzen Threadripper PRO 5995WX	108822	3330	280.0	388.65	64	2022	sWRX8	D
1	AMD EPYC 7763	88338	2635	280.0	315.49	64	2021	SP3	
2	AMD EPYC 7J13	86006	2387	NaN	NaN	64	2021	unknown	

In [49]:

```
# Checking for any duplicated row or any row without 'cpuMark'
print('Duplicated rows ', cleanedBenchmarks.duplicated().sum())
print('Rows without cpuMark ', cleanedBenchmarks.cpuMark.isnull().sum())
```

```
Duplicated rows  0
Rows without cpuMark  0
```

In [50]:

```
# Dataset shape before dropping rows with missing values
print('Rows ', cleanedBenchmarks.shape[0])
print('Columns ', cleanedBenchmarks.shape[1])
```

```
Rows  3825
Columns  9
```

In [51]:

```
# For simplicity, let's drop rows with any missing values in the remaining colum
cleanedBenchmarks.dropna(inplace = True)
```

In [52]:

```
# Dataset shape before dropping rows with missing values
print('Rows ', cleanedBenchmarks.shape[0])
print('Columns ', cleanedBenchmarks.shape[1])
```

```
Rows  3140
Columns  9
```

In [53]:

```
# Displaying the cleaned dataset's info and a preview
cleanedBenchmarks.info(), cleanedBenchmarks.head()
```

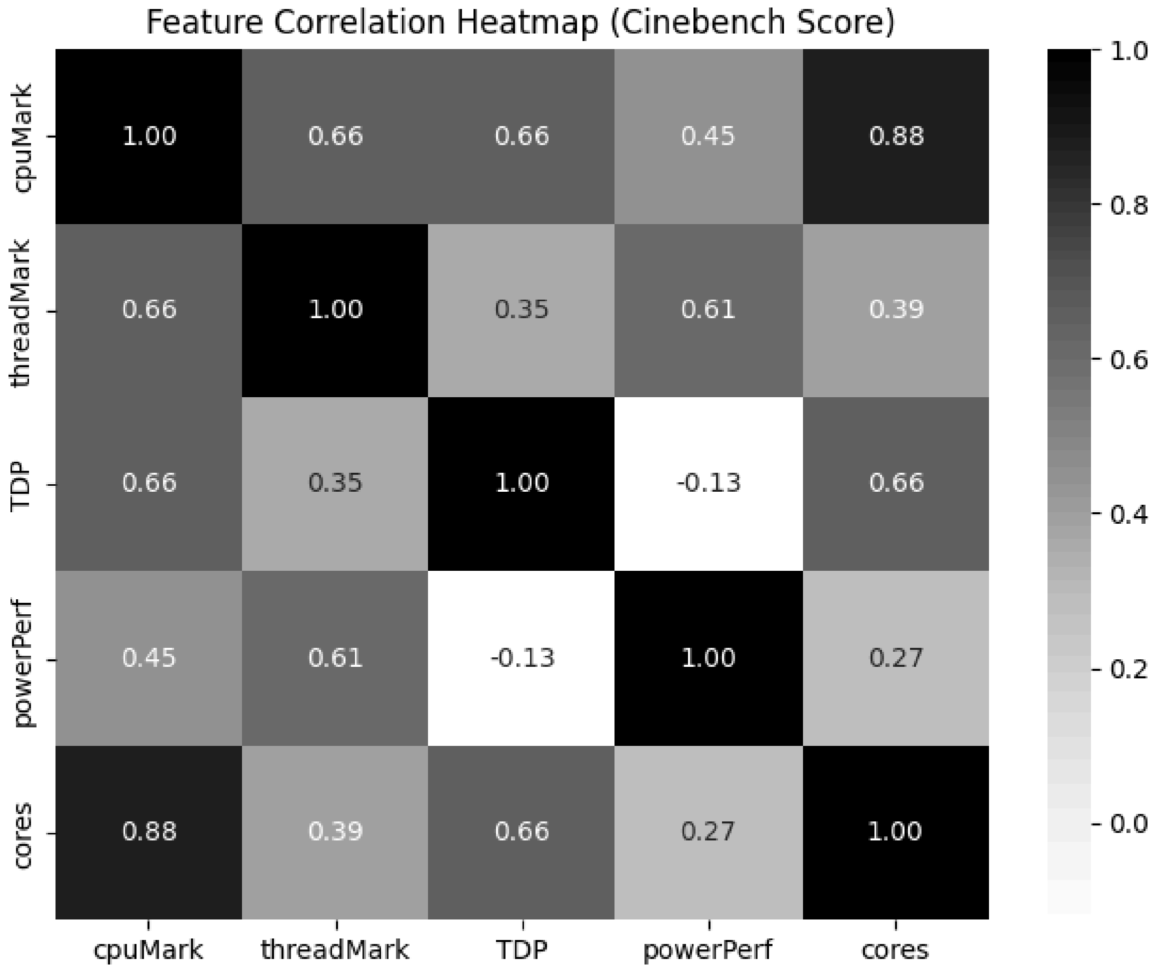
```
<class 'pandas.core.frame.DataFrame'>
Index: 3140 entries, 0 to 3824
Data columns (total 9 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   cpuName     3140 non-null   object 
 1   cpuMark     3140 non-null   int64  
 2   threadMark  3140 non-null   int64  
 3   TDP         3140 non-null   float64
 4   powerPerf   3140 non-null   object 
 5   cores       3140 non-null   int64  
 6   testDate    3140 non-null   int64  
 7   socket      3140 non-null   object 
 8   category    3140 non-null   object 
dtypes: float64(1), int64(4), object(4)
memory usage: 245.3+ KB
```

```
Out[53]:  (None,
                                   cpuName  cpuMark  threadMark    TDP powerPerf  \
  0  AMD Ryzen Threadripper PRO 5995WX   108822        3330  280.0    388.65   
  1                       AMD EPYC 7763    88338        2635  280.0    315.49   
  3                       AMD EPYC 7713    85861        2727  225.0     381.6   
  4  AMD Ryzen Threadripper PRO 3995WX    83971        2626  280.0     299.9   
  5       AMD Ryzen Threadripper 3990X    81568        2569  280.0    291.31   

     cores  testDate socket category  
  0     64      2022  sWRX8  Desktop  
  1     64      2021    SP3   Server  
  3     64      2021    SP3   Server  
  4     64      2020  sWRX8  Desktop  
  5     64      2020  sTRX4  Desktop  )
```

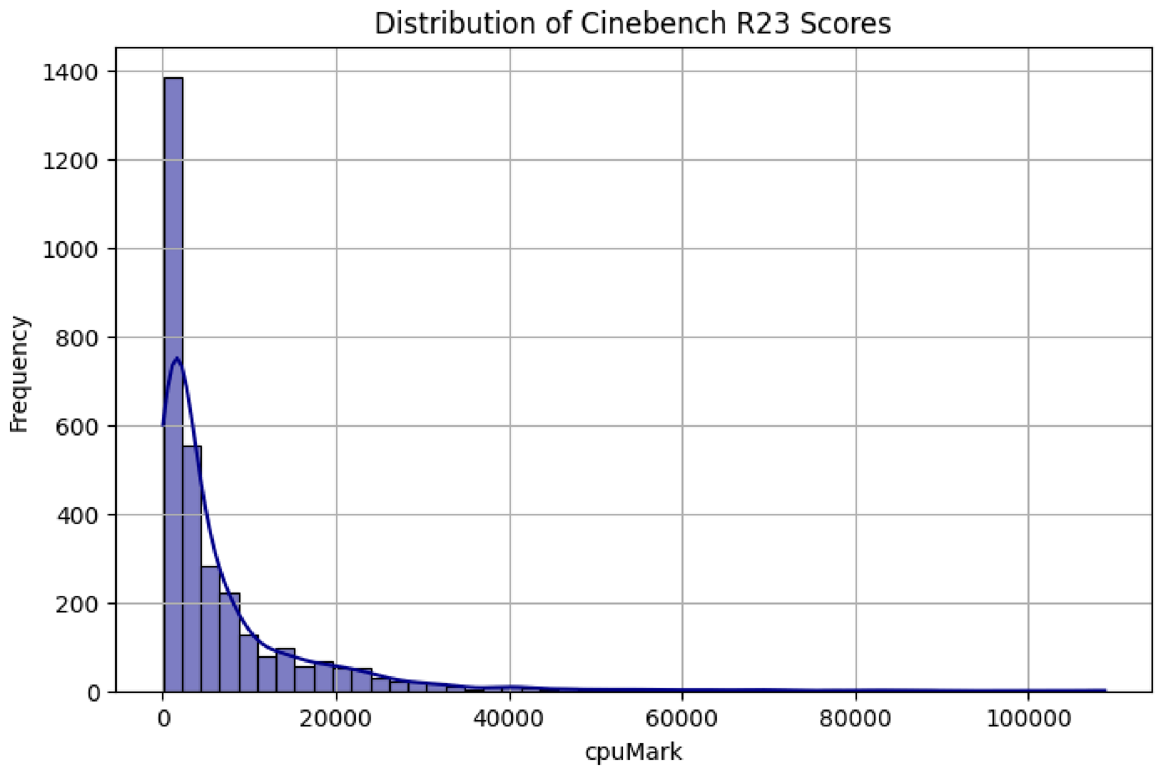
DataFrame Visualization

In [119…

```python
import seaborn as sns
import matplotlib.pyplot as plt

# Compute correlation matrix
corr = cleanedBenchmarks[['cpuMark', 'threadMark', 'TDP', 'powerPerf', 'cores']]

plt.figure(figsize = (8, 6))
sns.heatmap(corr, annot = True, cmap = 'Greys', fmt = ".2f")
plt.title("Feature Correlation Heatmap (Cinebench Score)")
plt.show()
```



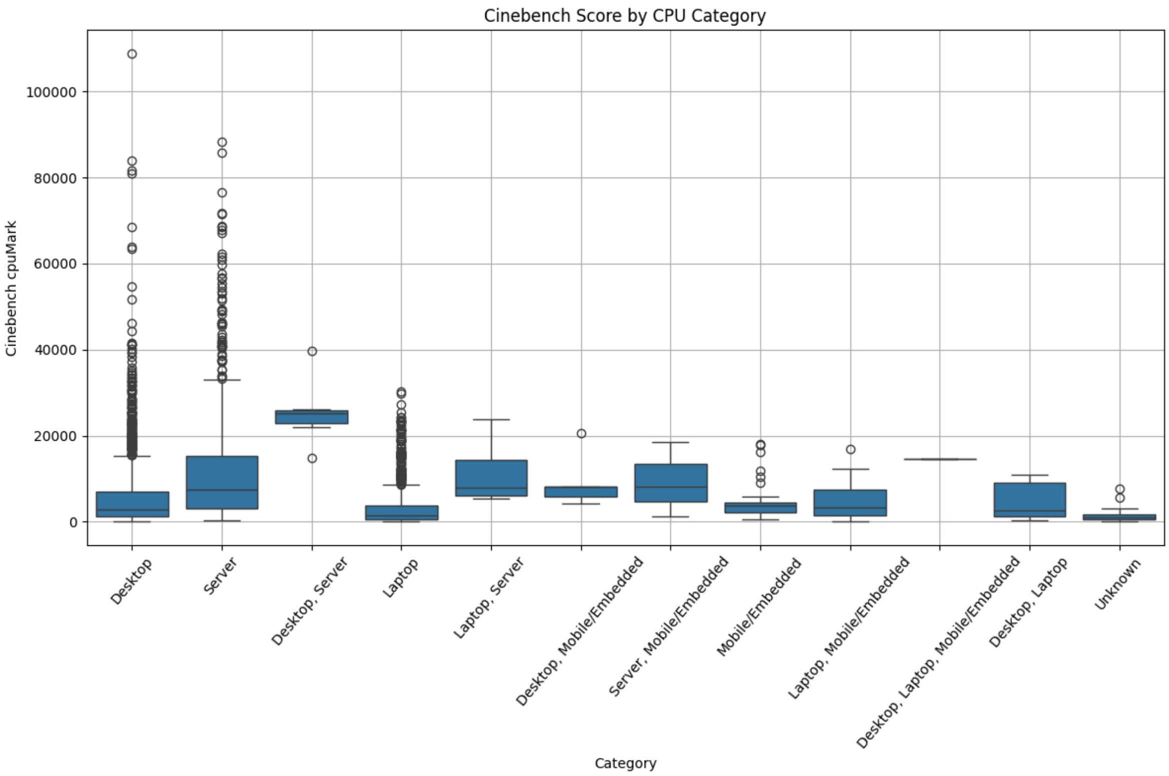
```
In [120…
plt.figure(figsize=(8, 5))
sns.histplot(cleanedBenchmarks['cpuMark'], bins = 50, kde = True, color = 'darkb
plt.title("Distribution of Cinebench R23 Scores")
plt.xlabel("cpuMark")
plt.ylabel("Frequency")
plt.grid(True)
plt.show()
```



In [121…

```
# Strip whitespace and fix case
cleanedBenchmarks['category'] = cleanedBenchmarks['category'].str.strip().str.ti

# Check unique categories
print("Unique categories:", cleanedBenchmarks['category'].unique())

plt.figure(figsize = (12, 8))
sns.boxplot(x = 'category', y = 'cpuMark', data = cleanedBenchmarks)
plt.title("Cinebench Score by CPU Category")
plt.xlabel("Category")
plt.ylabel("Cinebench cpuMark")
plt.xticks(rotation = 50)
plt.grid(True)
plt.tight_layout()
plt.show()
```

```
Unique categories: ['Desktop' 'Server' 'Desktop, Server' 'Laptop' 'Laptop, Serve
r'
 'Desktop, Mobile/Embedded' 'Server, Mobile/Embedded' 'Mobile/Embedded'
 'Laptop, Mobile/Embedded' 'Desktop, Laptop, Mobile/Embedded'
 'Desktop, Laptop' 'Unknown']
```



Model Selection Preprocessing

In [64]:

```
# Columns to clean
cols_to_clean = ['cpuMark', 'threadMark', 'powerPerf', 'TDP']

for col in cols_to_clean:
    cleanedBenchmarks[col] = cleanedBenchmarks[col].astype(str).str.replace(',',
```

In [56]:

```
# Importing Label Encoder and Train Test Split modules from sklearn
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
import numpy as np
```

In [65]:

```
# Creating a copy for modeling (just a precuation)
modelData = cleanedBenchmarks.copy()
```

In [66]:

```
# Encoding 'category' using LabelEncoder
le = LabelEncoder()
modelData['categoryEncoded'] = le.fit_transform(modelData['category'])
```

In [67]:

```
# Selecting features and target as X and y
features = ['cores', 'TDP', 'powerPerf', 'threadMark', 'categoryEncoded']
target = 'cpuMark'

X = modelData[features]
y = modelData[target]
```

In [68]:

```
# Spliting the dataset into Train and Test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, randc

# Shape of training and test data
print('Training data shape: ', X_train.shape)
print('Testing data shape: ', X_test.shape)
```

```
Training data shape:  (2512, 5)
Testing data shape:  (628, 5)
```

Model Training

In [62]:

```
# Importing LinearRegression and RandomForest, along with metrics
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
```

In [72]:

```
# 1. Linear Regression
lr_model = LinearRegression()
lr_model.fit(X_train, y_train)
```

Out[72]:

```
▾ LinearRegression  ⓘ ?

▶ Parameters
```

In [73]:

```
lr_preds = lr_model.predict(X_test)
```

In [74]:

```
# 2. Random Forest Regressor
rf_model = RandomForestRegressor(n_estimators=100, random_state=42)
rf_model.fit(X_train, y_train)
```

Out[74]:

```
▾ RandomForestRegressor  ⓘ ?

▶ Parameters
```

In [75]:

```
rf_preds = rf_model.predict(X_test)
```

Metrics Evaluation

In [122…

```
# Evaluation function
def evaluate_model(name, y_true, y_pred):
    print(f"\n📊 {name} Performance:")
    print("MAE:", round(mean_absolute_error(y_true, y_pred), 2))
    print("RMSE:", round(np.sqrt(mean_squared_error(y_true, y_pred)), 2))
    print("R² Score:", round(r2_score(y_true, y_pred), 4))

# Evaluating both models
evaluate_model("Linear Regression", y_test, lr_preds)
evaluate_model("Random Forest Regressor", y_test, rf_preds)
```

```
📊 Linear Regression Performance:
MAE: 2163.92
RMSE: 3365.97
R² Score: 0.9026

📊 Random Forest Regressor Performance:
MAE: 537.6
RMSE: 1428.43
R² Score: 0.9825
```

User Benchmarking (Model Prediction)

In [123…

```python
# Model Prediction Comparison Function
def compare_models_prediction(cores, tdp, powerPerf, threadMark, category_str):
    # Encoding category string (same as training)
    categoryEncoded = le.transform([category_str])[0]

    # Preparing input as a 2D array (as attributes)
    input_data = [[cores, tdp, powerPerf, threadMark, categoryEncoded]]

    # Prediction using Linear Regression
    lr_pred = lr_model.predict(input_data)[0]

    # Prediction using Random Forest
    rf_pred = rf_model.predict(input_data)[0]

    print(f"🧠 Linear Regression Predicted Score:     {round(lr_pred, 2)}")
    print(f"🌲 Random Forest Regressor Predicted Score: {round(rf_pred, 2)}")

    return lr_pred, rf_pred
```

In [125…

```python
import platform
import psutil
import cpuinfo

def get_user_system_specs():
    info = cpuinfo.get_cpu_info()
    cores = psutil.cpu_count(logical = False)
    threads = psutil.cpu_count()
    tdp = 65  # Placeholder; TDP is hard to read without an external DB
    powerPerf = round(psutil.cpu_freq().max, 2)  # MHz
    threadMark = threads * 100  # Approximate guess for now
    category = 'Desktop'  # Manual fallback or auto-detect based on chassis type

    print(f"Detected specs: {info['brand_raw']}, {cores} cores, {threads} thread

    return cores, tdp, powerPerf, threadMark, category

# Run and predict
specs = get_user_system_specs()
compare_models_prediction(*specs)
```

```
Detected specs: 12th Gen Intel(R) Core(TM) i5-12450H, 8 cores, 12 threads, 2000.0
MHz
🧠 Linear Regression Predicted Score:     26320.03
🌲 Random Forest Regressor Predicted Score: 6695.18
```

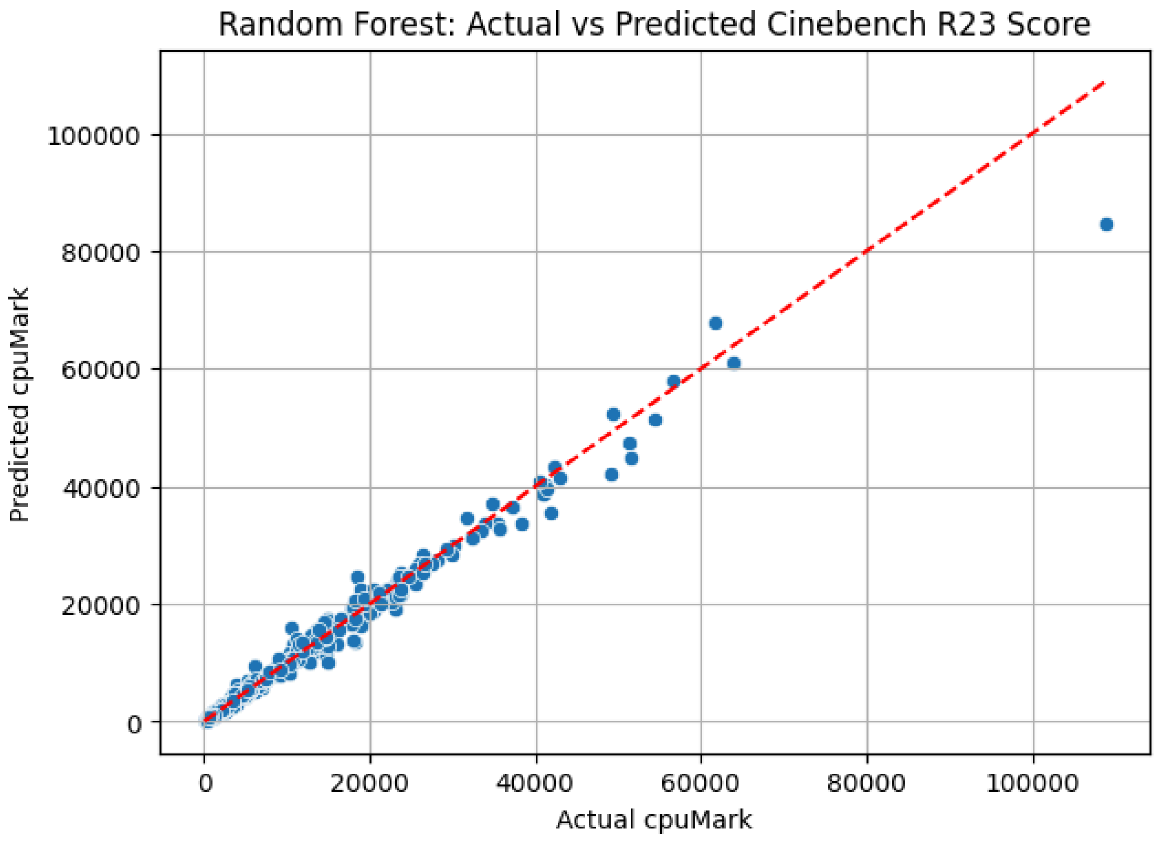
Out[125…

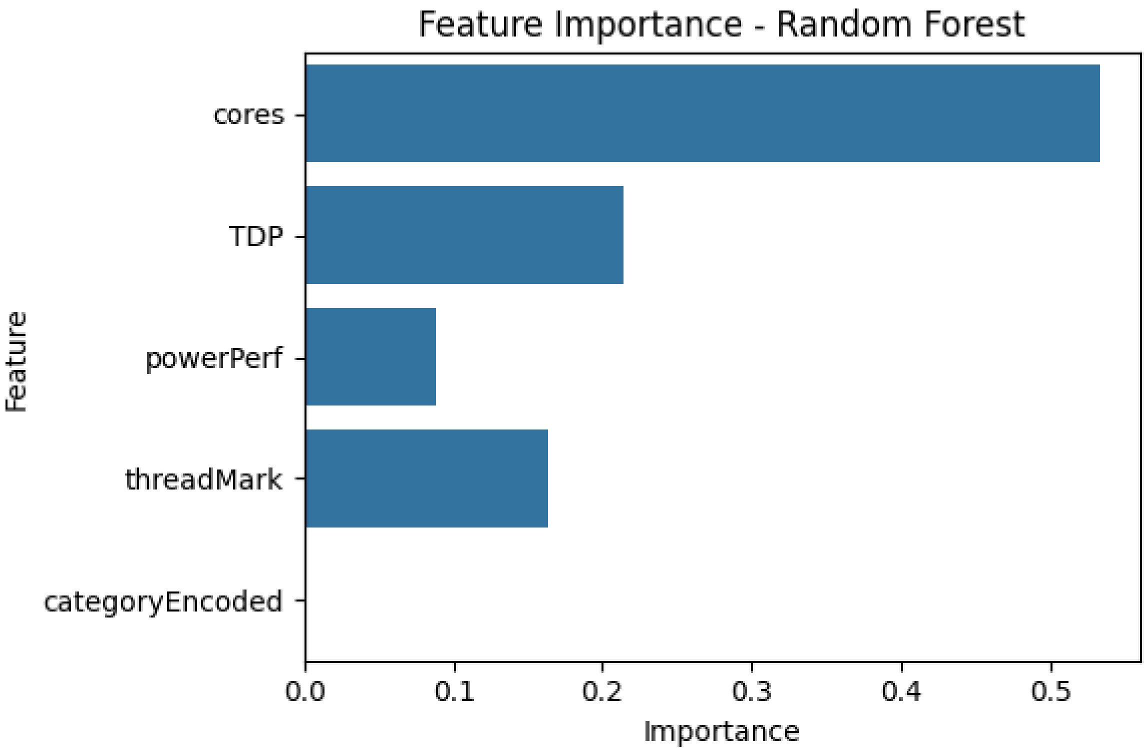
```
(np.float64(26320.027605306168), np.float64(6695.18))
```

Prediction Accuracy Measure

In [126…

```
import matplotlib.pyplot as plt
import seaborn as sns

# 1. Actual vs Predicted - Random Forest
plt.figure(figsize = (7, 5))
sns.scatterplot(x = y_test, y = rf_preds)
plt.xlabel("Actual cpuMark")
plt.ylabel("Predicted cpuMark")
plt.title("Random Forest: Actual vs Predicted Cinebench R23 Score")
plt.grid(True)
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], '--r')  # D
plt.show()

# 2. Feature Importance
importances = rf_model.feature_importances_
feat_names = X.columns

plt.figure(figsize = (6, 4))
sns.barplot(x = importances, y = feat_names)
plt.title("Feature Importance - Random Forest")
plt.xlabel("Importance")
plt.ylabel("Feature")
plt.tight_layout()
plt.show()
```





In [91]:

```python
# Importing warnings to ignore warnings from Jupyter
import warnings
warnings.filterwarnings('ignore')
```

In [129…

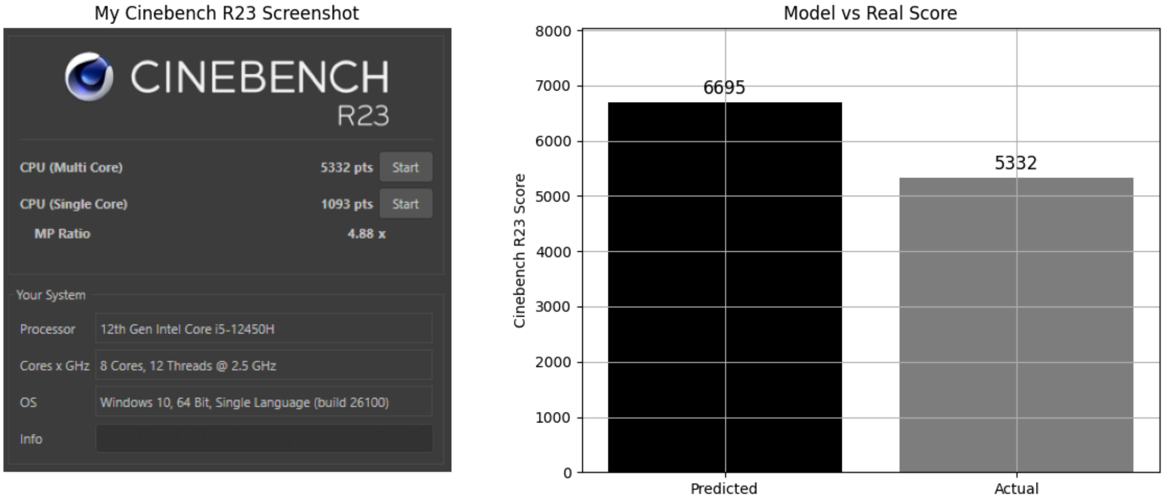
```python
import plotly.express as px

fig = px.scatter_3d(
    cleanedBenchmarks,
    x = 'cores',
    y = 'TDP',
    z = 'cpuMark',
    color = 'category',
    hover_data = ['cpuName'],
    title = "🧩 Interactive 3D: Cores vs TDP vs Cinebench Score"
)

fig.update_layout(
    width = 1000,
    height = 700,
    scene=dict(
        xaxis_title = 'Cores',
        yaxis_title = 'TDP',
        zaxis_title = 'cpuMark'
    )
)

fig.show()
```

Real World Comparison

In [130…

```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg

# Loading the Cinebench screenshot image
img = mpimg.imread("my_score.png")

actual_score = 5332
predicted_score = 6695

# Plot layout: image + score comparison
fig, ax = plt.subplots(1, 2, figsize = (12, 5))

# Screenshot
```

```
ax[0].imshow(img)
ax[0].axis('off')
ax[0].set_title("My Cinebench R23 Screenshot")

# Score comparison bar chart
ax[1].bar(["Predicted", "Actual"], [predicted_score, actual_score], color = ["bl
ax[1].set_title("Model vs Real Score")
ax[1].set_ylabel("Cinebench R23 Score")
ax[1].grid(True)
ax[1].set_ylim(0, max(actual_score, predicted_score) * 1.2)

for i, score in enumerate([predicted_score, actual_score]):
    ax[1].text(i, score + 150, f"{score}", ha = 'center', fontsize = 12)

plt.tight_layout()
plt.show()
```



My Cinebench R23 Screenshot

CINEBENCH R23

CPU (Multi Core) 5332 pts Start

CPU (Single Core) 1093 pts Start

MP Ratio 4.88 x

Your System

Processor: 12th Gen Intel Core i5-12450H

Cores x GHz: 8 Cores, 12 Threads @ 2.5 GHz

OS: Windows 10, 64 Bit, Single Language (build 26100)

Info:

Model vs Real Score

```
In [ ]:
```