REPRORODUCIBLE RESEARCH WITH BITCOIN FORECASTING

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BITCOIN TIME SERIES

Bitcoin is the longest running and most well known cryptocurrency, first released as open source in 2009 by the anonymous Satoshi Nakamoto. Bitcoin serves as a decentralized medium of digital exchange, with transactions verified and recorded in a public distributed ledger (the blockchain) without the need for a trusted record keeping authority or central intermediary. Transaction blocks contain a SHA-256 cryptographic hash of previous transaction blocks, and are thus "chained" together, serving as an immutable record of all transactions that have ever occurred. As with any currency/commodity on the market, bitcoin trading and financial instruments soon followed public adoption of bitcoin and continue to grow.

I will also diivide my document into two parts

- Data exploration. -Time series analysis.

Taking my time series further i will use

-ARIMA -SARIMA -PROPHET -To further the study my data is upto date to 2023 august.

THE NEWLY ADDED MODELS From my analysis am trying to improve the auhors work by adding the following two new models. 1. SARIMA 2. WAVENET MODEL

LIBRARIES USED IN THIS ANALYSIS

1. A character vector named lib is created to store the names of the desired R packages. Each package name is enclosed in double quotation marks and separated by commas.
2. The lapply() function is utilized to iterate over the elements of the lib vector. For each package name in the vector, the library() function is applied.
3. This loads the respective package into the R environment. The character.only argument is set to TRUE to indicate that only character strings (package names) are being passed. The purpose of running this code is to ensure that the listed packages are loaded and available for use within the R script. It's important to note the following:

Some packages, such as rnn, TSrepr, sarima, tensorflow, keras, aTSA, xgboost, tidymodels, timetk, fpp3, and biwavelet, may require additional installation steps, dependencies, or prerequisites to be set up properly. An active internet connection is necessary, as the packages are downloaded and installed from the CRAN repository if they're not already present.

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.2     v purrr     1.0.2
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.2     v tibble    3.2.1
## v lubridate 1.9.2     v tidyr     1.3.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
```

```
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
##
## Attaching package: 'plotly'
##
##
## The following object is masked from 'package:ggplot2':
##
##     last_plot
##
##
## The following object is masked from 'package:stats':
##
##     filter
##
##
## The following object is masked from 'package:graphics':
##
##     layout
##
##
## Loading required package: stats4
##
##
## Attaching package: 'sarima'
##
##
## The following object is masked from 'package:stats':
##
##     spectrum
##
##
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
##
##
## Attaching package: 'aTSA'
##
##
## The following object is masked from 'package:forecast':
##
##     forecast
##
##
## The following object is masked from 'package:graphics':
##
##     identify
##
##
##
## Attaching package: 'xgboost'
##
```

```
##
## The following object is masked from 'package:plotly':
##
##     slice
##
##
## The following object is masked from 'package:dplyr':
##
##     slice
##
##
## -- Attaching packages --------------------------------------- tidymodels 1.1.0 --
##
## v broom        1.0.5     v rsample      1.1.1
## v dials        1.2.0     v tune         1.1.1
## v infer        1.0.4     v workflows    1.1.3
## v modeldata    1.2.0     v workflowsets 1.0.1
## v parsnip      1.1.0     v yardstick    1.2.0
## v recipes      1.0.7
##
## -- Conflicts ------------------------------------------ tidymodels_conflicts() --
## x yardstick::accuracy()    masks forecast::accuracy()
## x scales::discard()        masks purrr::discard()
## x plotly::filter()         masks dplyr::filter(), stats::filter()
## x recipes::fixed()         masks stringr::fixed()
## x yardstick::get_weights() masks keras::get_weights()
## x dplyr::lag()             masks stats::lag()
## x yardstick::mae()         masks TSrepr::mae()
## x yardstick::mape()        masks TSrepr::mape()
## x yardstick::mase()        masks TSrepr::mase()
## x yardstick::rmse()        masks TSrepr::rmse()
## x xgboost::slice()         masks plotly::slice(), dplyr::slice()
## x yardstick::smape()       masks TSrepr::smape()
## x yardstick::spec()        masks readr::spec()
## x recipes::step()          masks stats::step()
## x recipes::update()        masks stats4::update(), stats::update()
## * Use suppressPackageStartupMessages() to eliminate package startup messages
##
## -- Attaching packages ---------------------------------------------- fpp3 0.5 --
##
## v tsibble     1.1.3     v fable       0.3.3
## v tsibbledata 0.4.1     v fabletools  0.3.3
## v feasts      0.3.1
##
## -- Conflicts ------------------------------------------------- fpp3_conflicts --
## x fabletools::accuracy()        masks yardstick::accuracy(), forecast::accuracy()
## x lubridate::date()             masks base::date()
## x scales::discard()             masks purrr::discard()
## x fabletools::estimate()        masks aTSA::estimate()
## x plotly::filter()              masks dplyr::filter(), stats::filter()
## x fabletools::forecast()        masks aTSA::forecast(), forecast::forecast()
## x fabletools::generate()        masks infer::generate()
## x fabletools::hypothesize()     masks infer::hypothesize()
## x tsibble::intersect()          masks base::intersect()
```

```
## x tsibble::interval()           masks lubridate::interval()
## x dplyr::lag()                  masks stats::lag()
## x fabletools::new_model_class() masks keras::new_model_class()
## x fabletools::null_model()      masks parsnip::null_model()
## x tsibble::setdiff()            masks base::setdiff()
## x xgboost::slice()              masks plotly::slice(), dplyr::slice()
## x tsibble::union()              masks base::union()
##
## biwavelet 0.20.21 loaded.
##
##
## Attaching package: 'biwavelet'
##
##
## The following object is masked from 'package:ggplot2':
##
##     arrow
## [[1]]
## [1] "readr"     "stats"     "graphics"  "grDevices" "utils"     "datasets"
## [7] "methods"   "base"
##
## [[2]]
##  [1] "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"     "tidyr"
##  [7] "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"     "graphics"
## [13] "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[3]]
##  [1] "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"     "tidyr"
##  [7] "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"     "graphics"
## [13] "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[4]]
##  [1] "rnn"       "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"
##  [7] "tidyr"     "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"
## [13] "graphics"  "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[5]]
##  [1] "rnn"       "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"
##  [7] "tidyr"     "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"
## [13] "graphics"  "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[6]]
##  [1] "rnn"       "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"
##  [7] "tidyr"     "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"
## [13] "graphics"  "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[7]]
##  [1] "plotly"    "rnn"       "lubridate" "forcats"   "stringr"   "dplyr"
##  [7] "purrr"     "tidyr"     "tibble"    "ggplot2"   "tidyverse" "readr"
## [13] "stats"     "graphics"  "grDevices" "utils"     "datasets"  "methods"
## [19] "base"
##
## [[8]]
```

```
##  [1] "gganimate" "plotly"    "rnn"       "lubridate" "forcats"   "stringr"
##  [7] "dplyr"     "purrr"     "tidyr"     "tibble"    "ggplot2"   "tidyverse"
## [13] "readr"     "stats"     "graphics"  "grDevices" "utils"     "datasets"
## [19] "methods"   "base"
##
## [[9]]
##  [1] "TSrepr"    "gganimate" "plotly"    "rnn"       "lubridate" "forcats"
##  [7] "stringr"   "dplyr"     "purrr"     "tidyr"     "tibble"    "ggplot2"
## [13] "tidyverse" "readr"     "stats"     "graphics"  "grDevices" "utils"
## [19] "datasets"  "methods"   "base"
##
## [[10]]
##  [1] "sarima"    "stats4"    "TSrepr"    "gganimate" "plotly"    "rnn"
##  [7] "lubridate" "forcats"   "stringr"   "dplyr"     "purrr"     "tidyr"
## [13] "tibble"    "ggplot2"   "tidyverse" "readr"     "stats"     "graphics"
## [19] "grDevices" "utils"     "datasets"  "methods"   "base"
##
## [[11]]
##  [1] "tensorflow" "sarima"     "stats4"     "TSrepr"     "gganimate"
##  [6] "plotly"     "rnn"        "lubridate"  "forcats"    "stringr"
## [11] "dplyr"      "purrr"      "tidyr"      "tibble"     "ggplot2"
## [16] "tidyverse"  "readr"      "stats"      "graphics"   "grDevices"
## [21] "utils"      "datasets"   "methods"    "base"
##
## [[12]]
##  [1] "keras"      "tensorflow" "sarima"     "stats4"     "TSrepr"
##  [6] "gganimate"  "plotly"     "rnn"        "lubridate"  "forcats"
## [11] "stringr"    "dplyr"      "purrr"      "tidyr"      "tibble"
## [16] "ggplot2"    "tidyverse"  "readr"      "stats"      "graphics"
## [21] "grDevices"  "utils"      "datasets"   "methods"    "base"
##
## [[13]]
##  [1] "forecast"   "keras"      "tensorflow" "sarima"     "stats4"
##  [6] "TSrepr"     "gganimate"  "plotly"     "rnn"        "lubridate"
## [11] "forcats"    "stringr"    "dplyr"      "purrr"      "tidyr"
## [16] "tibble"     "ggplot2"    "tidyverse"  "readr"      "stats"
## [21] "graphics"   "grDevices"  "utils"      "datasets"   "methods"
## [26] "base"
##
## [[14]]
##  [1] "aTSA"       "forecast"   "keras"      "tensorflow" "sarima"
##  [6] "stats4"     "TSrepr"     "gganimate"  "plotly"     "rnn"
## [11] "lubridate"  "forcats"    "stringr"    "dplyr"      "purrr"
## [16] "tidyr"      "tibble"     "ggplot2"    "tidyverse"  "readr"
## [21] "stats"      "graphics"   "grDevices"  "utils"      "datasets"
## [26] "methods"    "base"
##
## [[15]]
##  [1] "xgboost"    "aTSA"       "forecast"   "keras"      "tensorflow"
##  [6] "sarima"     "stats4"     "TSrepr"     "gganimate"  "plotly"
## [11] "rnn"        "lubridate"  "forcats"    "stringr"    "dplyr"
## [16] "purrr"      "tidyr"      "tibble"     "ggplot2"    "tidyverse"
## [21] "readr"      "stats"      "graphics"   "grDevices"  "utils"
## [26] "datasets"   "methods"    "base"
```

```
##
## [[16]]
##  [1] "yardstick"    "workflowsets" "workflows"    "tune"         "rsample"
##  [6] "recipes"      "parsnip"      "modeldata"    "infer"        "dials"
## [11] "scales"       "broom"        "tidymodels"   "xgboost"      "aTSA"
## [16] "forecast"     "keras"        "tensorflow"   "sarima"       "stats4"
## [21] "TSrepr"       "gganimate"    "plotly"       "rnn"          "lubridate"
## [26] "forcats"      "stringr"      "dplyr"        "purrr"        "tidyr"
## [31] "tibble"       "ggplot2"      "tidyverse"    "readr"        "stats"
## [36] "graphics"     "grDevices"    "utils"        "datasets"     "methods"
## [41] "base"
##
## [[17]]
##  [1] "timetk"       "yardstick"    "workflowsets" "workflows"    "tune"
##  [6] "rsample"      "recipes"      "parsnip"      "modeldata"    "infer"
## [11] "dials"        "scales"       "broom"        "tidymodels"   "xgboost"
## [16] "aTSA"         "forecast"     "keras"        "tensorflow"   "sarima"
## [21] "stats4"       "TSrepr"       "gganimate"    "plotly"       "rnn"
## [26] "lubridate"    "forcats"      "stringr"      "dplyr"        "purrr"
## [31] "tidyr"        "tibble"       "ggplot2"      "tidyverse"    "readr"
## [36] "stats"        "graphics"     "grDevices"    "utils"        "datasets"
## [41] "methods"      "base"
##
## [[18]]
##  [1] "fable"        "feasts"       "fabletools"   "tsibbledata"  "tsibble"
##  [6] "fpp3"         "timetk"       "yardstick"    "workflowsets" "workflows"
## [11] "tune"         "rsample"      "recipes"      "parsnip"      "modeldata"
## [16] "infer"        "dials"        "scales"       "broom"        "tidymodels"
## [21] "xgboost"      "aTSA"         "forecast"     "keras"        "tensorflow"
## [26] "sarima"       "stats4"       "TSrepr"       "gganimate"    "plotly"
## [31] "rnn"          "lubridate"    "forcats"      "stringr"      "dplyr"
## [36] "purrr"        "tidyr"        "tibble"       "ggplot2"      "tidyverse"
## [41] "readr"        "stats"        "graphics"     "grDevices"    "utils"
## [46] "datasets"     "methods"      "base"
##
## [[19]]
##  [1] "biwavelet"    "fable"        "feasts"       "fabletools"   "tsibbledata"
##  [6] "tsibble"      "fpp3"         "timetk"       "yardstick"    "workflowsets"
## [11] "workflows"    "tune"         "rsample"      "recipes"      "parsnip"
## [16] "modeldata"    "infer"        "dials"        "scales"       "broom"
## [21] "tidymodels"   "xgboost"      "aTSA"         "forecast"     "keras"
## [26] "tensorflow"   "sarima"       "stats4"       "TSrepr"       "gganimate"
## [31] "plotly"       "rnn"          "lubridate"    "forcats"      "stringr"
## [36] "dplyr"        "purrr"        "tidyr"        "tibble"       "ggplot2"
## [41] "tidyverse"    "readr"        "stats"        "graphics"     "grDevices"
## [46] "utils"        "datasets"     "methods"      "base"
```