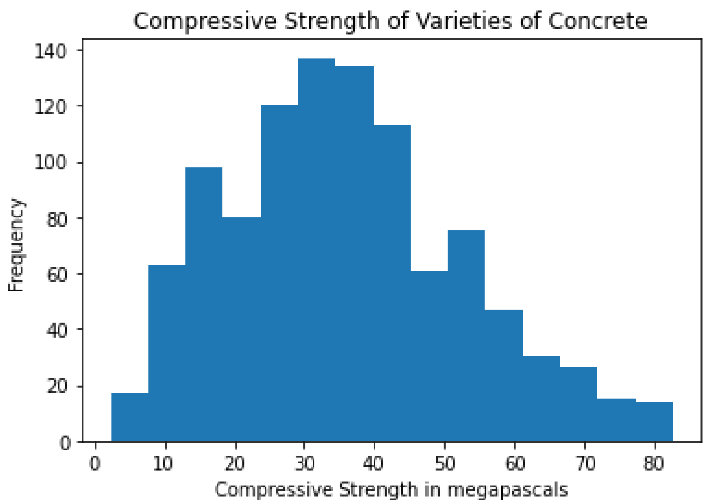
Concrete Strength Project

Kaleb Coggins, Ayobami Ajala, Evan Peterson

The given database contains samples of concrete and their attributes, including density of cement, blast furnace slag, fly ash, water, superplasticizer, coarse aggregate, and fine aggregate present in the mixture as well as its age and compressive strength. There are 1030 concretes samples, and no missing values. All the numbers in the database are floating point values, except for the age, which is an integer. Below are statistics of each column including five number summaries, and a histogram of the values of compressive strength, which will represent the dependent variable in our model.

	Cement (component 1)(kg in a m^3 mixture)	Blast Furnace Slag (component 2)(kg in a m^3 mixture)	Fly Ash (component 3)(kg in a m^3 mixture)	Water (component 4)(kg in a m^3 mixture)	Superplasticizer (component 5)(kg in a m^3 mixture)	Coarse Aggregate (component 6)(kg in a m^3 mixture)	Fine Aggregate (component 7)(kg in a m^3 mixture)	Age (day)	Concrete compressive strength(MPa, megapascals)
count	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000
mean	281.165631	73.895485	54.187136	181.566359	6.203112	972.918592	773.578883	45.662136	35.817836
std	104.507142	86.279104	63.996469	21.355567	5.973492	77.753818	80.175427	63.169912	16.705679
min	102.000000	0.000000	0.000000	121.750000	0.000000	801.000000	594.000000	1.000000	2.331808
25%	192.375000	0.000000	0.000000	164.900000	0.000000	932.000000	730.950000	7.000000	23.707115
50%	272.900000	22.000000	0.000000	185.000000	6.350000	968.000000	779.510000	28.000000	34.442774
75%	350.000000	142.950000	118.270000	192.000000	10.160000	1029.400000	824.000000	56.000000	46.136287
max	540.000000	359.400000	200.100000	247.000000	32.200000	1145.000000	992.600000	365.000000	82.599225



Our project will begin with research about designing the correct mixture of concrete and the importance of having an adequate compressive strength. Having a model that can be used to predict the strength of different types of concrete is a much more efficient method than manually creating each variety of concrete, so this is a very relevant and practical project. The research will be conducted by Aj.

The main plan for our program is we will create an interface that can either predict the compressive strength of a potential concrete sample based on the properties inputted by the user, or add the data from a proven experiment of the compressive strength of a sample of concrete to the database. For the former, it will check if the imputed values already exist in the database, and if they do it will return the strength that is already given in the data. If it cannot find any existing records of the imputed values, then it will insert them into an equation to give an estimated value for the strength of the concrete. There will be a second option to add a new type of concrete from a proven experiment to the database, putting a new value into the records to be called upon later. The equation for predicting concrete strength will also be recalculated when something is added to the data.

To put this into action, we will design a user interface from an imported module to create a menu that will allow for two separate screens, strength estimation and record addition. When the user selects the strength estimation, they will be provided boxes to input the properties of the concrete. First, the data will be checked with the database to see if any existing duplicate records exist, and if one does it will be returned. On the other hand, if a record does not exist, it will be run through an equation to find the estimated compressive strength along with the uncertainty margin. The user will be shown both the range that the strength will be in with 95% confidence and the predicted exact value. These values will not be added in the database as the calculation is only an estimation of what the strength should be, and therefore not a proven value. Instead, there will be a second option on the menu for adding proven records to the database. For this, the user will be prompted to add all the data including the concrete strength, which will then be added to the database. Every time this happens, the program will automatically update the equation used to predict compressive strength so that it will be more accurate. Aj will design the user interface, Evan will create the estimation model to predict compressive strength, and Kaleb will program the addition of proven concrete strengths to the database.

To find the equation for estimating the concrete strength, we will use a multiple linear regression model, which will factor in all the attributes of the concrete present in the database to predict its strength. This will involve first importing a module that can calculate multiple linear regression, then training the model, and finally calculating the accuracy of the model by comparing it to known data values.

As for the data addition function, it is a fairly simple task since just it consists of appending the existing database. It will be read into a pandas dataframe using the function “pandas.read_excel(),” and we will add data as rows to the end of the database. Modifying the original excel file would require writing a new file and converting to an excel format. There is no need to organize the data in any way, as most plotting and search functions don't require an organized list.