COVID-19 and Startups Investments Analysis

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1 MOTIVATION

In general startup companies in order to grow require investments and fundings from venture capitals and investment companies, and after exploring the Crunchbase dataset [1], it was clear that many factors were making or breaking certain investments from companies or investors.

After looking over works related to startups and investments[7, 8, 10], and especially having events affecting these startups like the novel COVID-19 recently [9, 11], we got inspired to question how much the startup companies have been affected during these times, comparing to before, in more details and classifications, especially to show how much the types of these companies, from tech startups to medical-related startup, have been affected in terms of funding and profitability.

2 PROBLEM DEFINITION

Investment not only can ensure investor's financial security. but also provide them with financial support and income. During recent years, because of economic changes with the influence of the pandemic started in the year 2020, the investment environment and opportunities for investors have changed greatly this year, the situation for unicorn startup companies also changed greatly because of these reasons. In this project, our team decided to do an analysis to find out the changes in the investment environment between the years 2017-18 until 2020. We will use data from reliable online datasets, by using and applying proper methods and algorithms to analyze the relationship between startup companies and their investors and find out the investment changes between these 2 years. Our work will not only demonstrate the changes that happened to the investment opportunities because of COVID-19 by comparing data from 2019 and 2020, but it will also show the investment funding changes in different major fields of companies. Our team will use these results to analyze and hypothesize the reasons for these changes that appear in our report.

Furthermore, in future studies and expansion of our model, it will have more details added to the analysis and can be expanded to do more accurate analysis. By expanding the domain to all major companies around the world, and linking those changes with more

big events or news that happened at the corresponding timestamp, we will be able to analyze changes that pandemic and the political and economic changes are doing to the investment environment recently, and even predict the future of the investing environment if the pandemic continues.

3 METHODOLOGY

Our database includes fundings from Investors to companies in different rounds along with other details about that funding. These details include valuation, total equity funding, Industry, top investors, last funding, etc. It also includes date information about some of the attributes mentioned.

Initially, we will create a graph where the nodes are either companies or investors and there will be an edge between the nodes if an investor funded another company. This will create our main reference Investor-Company graph.

Since investing companies rarely fund other investing companies we expect this graph to be close to a Bipartite graph, where the nodes on one side are the companies and the nodes on the other side are investors.

Furthermore, we will create this type of Investor-Company graph using data from companies in different industries (Tech, Med, etc.) separately. Also, there will be two versions of each graph, one for fundings made before Covid-19 and one for fundings after it. So assuming we have n industries, there will be 2n Investor-Company graphs created.

The Investor-Company graph describes the relation between investors and companies. In order to understand the relations between one investor and other investors and similarly, the relation between a funded company with other funded companies, we'll derive two more types of graphs from our original Investor-Company graphs:

- **Investor-Investor:** We'll create a graph where the nodes will only be Investing companies. There will be an edge between these nodes if they funded the same company.
- **Company-Company:** We'll create a graph where the nodes will only be unicorn startups. There will be an edge between the nodes if two unicorn companies received fundings from the same investor.

These two new graphs will help us have a better understanding of how companies in different industries are funded. Moreover, since

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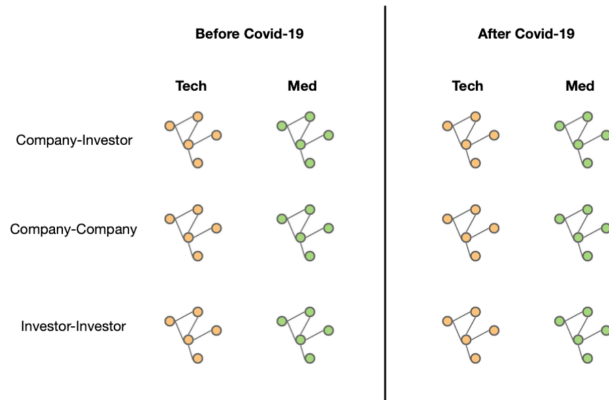
Figure 1: Overview of the different graph types based on timestamps around COVID-19 occurrences.

we're making these two new graph types using data before and after Covid-19, we can see if Covid has affected the way investors and companies are related to each other. The overall structure of our models described above can be seen in Figure.1.

4 EVALUATION

Since the project mainly focuses on reflecting on the effects and fluctuations regarding the funding and investments through time (especially the effects of major events like the recent pandemic), our main focus will be regarding the appropriate dataset from pre and post COVID-19 incidents.

The graph properties we will examine involve some of the following: computing the Degree Distribution of each of the graphs, Centrality, and their Edge Count. We are looking forward to applying some of the graph algorithms with the help of some libraries and their "Clustering"[2, 4, 6] and "Community Detection"[3, 5] algorithms algorithms over all the generated graphs.

Using the analysis above, our goal is to hypothesize and analyse the possible implications of COVID-19 on investment-company relationships at a deeper level. Our aim is to reflect on the mathematical analysis onto the real life application and meaning of them.

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