

Executive Summary

Trading in financial markets as an individual takes time and effort. According to our recent survey, 80% of individuals trading online (ranging in age from 19 to 40) do not conduct any form of analysis before placing a trade – those who do, tend to use simple methods lacking scientific support. The most successful trading firms have teams of quantitative researchers utilising many techniques involving statistics and machine learning. These advanced methods are not widely available, leaving the average individual at a decisive disadvantage. We estimate a market value for these individuals of approximately £17.3m (based on potential per annum revenue).

We introduce a new tool, powered by state-of-the-art deep learning, to enable an individual to conduct faster and more accurate quantitative and technical analysis on their trades. The technology we intend to use is both new (first devised in 2020) and has never been applied to financial markets before.

Importantly, using our tool requires no prior knowledge of machine learning, mathematics, or programming. We will deliver our tool via an online subscription to a web application with ease-of-use and simplicity as its primary focus. We plan to evolve our product to include a suite of other tools, trading blogs, trading tutorials, and we hope to develop an online community of people open to sharing ideas.

Figure 1 in Appendix B shows an outline of our impact plan. We plan to use crowdfunding to raise initial capital and gather willing users for closed beta testing whilst running series A, B, and C funding rounds. For the first few years, our retained earnings will be invested back into the company for marketing and further product research/development.

Evaluation of the Potential Opportunity

Opportunity

Many people lack the necessary skills or tools to trade. Our survey found that 75% of those who do not trade cite high risk, lack of analysis tools, or lack of knowledge as reasons. It is also estimated that ¹80% of people who begin trading end up losing money. Successful trading firms often rely on quantitative analysis and strategy backtesting carried out by teams of internal researchers. These quantitative methods usually involve technical indicators, machine learning, time series analysis, statistics, and risk-management techniques, which are not readily available to the general individual. ²According to the Financial Conduct Authority, large banks and insurers in the U.K. are expected to more than double their use of machine learning in the next three years. The FCA estimate that two-thirds of financial service businesses are now using some form of machine learning, giving them a decisive advantage over individuals.

Providing more accurate and efficient time series analysis tools for finance using recent advancements in deep learning will have several beneficiaries. Notably, the ordinary individual trading online, who may have little knowledge of machine learning, mathematics, or programming. Although we would also offer value to experienced traders and trading firms, it may be challenging to sell to them given that most already have quantitative research/infrastructure in place.

Market Size

We intend to target individuals. ³Due to the sheer volume and composition of traders and investors in the market (high-frequency algorithmic traders, hedge funds, investment banks, individuals etc.), it is not easy to pinpoint the exact market size. However, it is safe to assume that the number of online traders has experienced excess growth in recent years.

Individuals Trading Online Market Size & Growth

In 2017, ⁴The Modern Trader report estimated there to be 9.6m individuals trading online. By 2018, this figure had increased to 13.9m. ⁵In 2020, Robinhood (a single online trading platform) revealed it had 13m active users - estimated to be closer to 20m in 2021. ⁶eToro, a similar platform, boasts 20m users in 2021. According to ⁷Bloomberg intelligence via the Wall Street Journal, individual investors make up 19.5% of ⁸U.S. equity trading volume (\$24.48b). This was a 4% increase from 2019 and 100% from 2010. The modern trader report also found the U.K. to have the most online traders globally. Figure 2 in Appendix B illustrates our average target user demographic.

⁹TradingView, a similar company providing trading tools online, reported an estimated ¹⁰17m monthly active users. According to our survey, 70% of these users would be prepared to use our tools. A conservative estimate for this area of the market would therefore be 4.25m. Of those who trade online without analytics, 85% said they would use our tool. Therefore, a conservative estimate would be 10% of the number of people trading online in 2018 (due to recent market growth, this is a moderate estimate). This adds an additional 1.39m people to the market – giving a total market size of 5.64m. This does not include those who don't currently trade online but would consider starting if they had access to our tool (approximately 60%). A market value is calculated in the impact plan based on our proposed product pricing.

Recent activity in the markets has sparked new interest in trading. ¹¹A subreddit named “wallstreetbets” enabled many individuals, who had never traded before, to execute a short squeeze on multiple billion-dollar hedge funds. This has brought much attention to trading online, with many online trading platforms receiving considerable criticism for making stocks like GME (GameStop) untradeable. ¹²Cryptocurrencies like Bitcoin have also been subject to much attention recently, with popular voices such as Elon Musk investing heavily. This, combined with the limited research on our technology (particularly for time series forecasting), leads us to believe it is crucial to act now.

Competitors

Our secondary competitors are online trading platforms with additional trading tools included in their subscription. They offer well-known technical indicators, as opposed to the bespoke tool provided by us, and are largely focused on the key area of their business (executing trades). We believe our technology will be disruptive in this market. Examples of these platforms include Oanda, Ally Invest, Charles Schwab, E*Trade, TD Ameritrade and Robinhood.

Perhaps our more direct competitors are the web applications solely offering analysis tools. Again, we believe the effectiveness of our unique tool will give us a competitive advantage. It would also be possible to extend our service to offer a suite of tools, including our competitors' publicly available tools. This extension should allow us to perform at least as well as them. It should also be noted that an individual may not want to limit themselves to one platform's tool suite. As such, we won't have to 'steal' clients from our competitors, but rather offer our tool as a valuable addition. Examples of these platforms include Stockopedia, TradingView, MetaStock, tc2000 and eSignal.

Value Proposition

Product

Our product uses an ¹³Ordinary-Differential-Equation-Long-Short-Term-Memory neural network (ODE-LSTM), which was first devised in 2020, to allow users to perform complex time series forecasting on any

financial data. The tool will be delivered as a web application via the cloud, with customisable inputs. For example, suppose a user wishes to develop an advanced technical indicator for a particular stock to generate buy/sell signals. In that case, they can select regular price data as an input to the neural network. If a user wishes to perform more in-depth quantitative analysis, they may want to include other variables such as limit-order-book information or price-to-earnings ratios. We fully automate this analysis to allow someone with no machine learning or quantitative experience to perform effective time series forecasting. The use of ODE-LSTMs is a unique approach to market analysis, which should give us a competitive edge over alternatives.

Pains

Many individuals lack the time, effort, and resources to perform any analysis or forecasting on financial data before making their trades. When they do perform analysis, it is often a simple ¹⁴technical analysis using common techniques such as stochastics, moving averages, relative strength index or money flow index. These techniques lack scientific backing and often prove to be ineffective. Advanced ¹⁵quantitative analysis is often expensive, complicated to perform and takes time to run.

Ease-of-use

We allow traders to utilise state of the art deep learning methods when trading. Our tool can be used as an additional check when making a trade or as a method for finding new trades. Through a cheap, subscription-based model, users will have access to an accurate and well-tested set of deep learning tools. The product is enjoyable, straightforward and (due to automation) easy to use.

Speed

Training and querying the networks will be faster than alternatives thanks to the efficiency of neural ODEs. ¹⁶Dauvenaud et al. (2018) demonstrated that ODEs operate with constant memory, as opposed to linear memory with respect to the number of layers. As such, increasing the depth and complexity of a neural network increases the memory advantage of an ODE. Additionally, Dauvenaud et al. showed that the number of evaluations in the backward pass is roughly half that of the forward pass. Fewer evaluations yield increased computational efficiency over standard neural networks utilising backpropagation. This doubling of speed and polynomial increase of memory efficiency will ensure faster trades and potentially generate more profit.

Accuracy

Experimentation on ODE-LSTMs is still relatively sparse. ¹⁷In 2019, Rubanova et al. performed time series prediction on the ¹⁸“PhysioNet Challenge 2012 dataset” using several neural networks. The ODE-RNN (similar to our model) showed a 33% decrease in error when compared with traditional RNNs. It should also be noted that even the less accurate traditional RNNs are not currently readily available to the general trader in the way we wish to provide ODE-LSTMs. A combination of these points should offer a significant accuracy incentive to our target market.

Impact Plan

Timeline Until Initial Release

Figure 1 in Appendix B shows a detailed layout of the planned event timeline until our initial release. Series A, B, and C funding may be launched if necessary. Further validation of our product is required and will be carried out on crowd funders and initial users. Given that our product merely acts as an aid to

investors, and that any proprietary trading we undertake will be performed through a broker – ¹⁹FCA authorisation is not necessary. Our web application will run on AWS Lambda (for autoscaling).

Pricing

We plan to offer our product to users via a monthly subscription. Our survey indicated people were prepared to pay from as little as €5 (£4.28) to as much as £50 per month. The survey also revealed that people who were already trading with other analysis tools were prepared to pay more than people who had never traded before. ²⁰TradingView offers four subscription options: Basic, Pro, Pro+, and Premium, costing \$0, \$14.95, \$29.95, and \$59.95, respectively. Due to the range of prices people were willing to pay, and TradingView's tried and tested model, we believe it is best to deliver three different pricing options. Freemium users will pay £0pm but will be subject to ads and will not have access to our model's full customisation options or features. Pro users will pay £5pm for no ads and more customisation/features. Premium users will pay £20pm for the full range of features we offer. The exact difference between features provided to the various user types will be finetuned during closed beta testing on our crowd funders.

Revenue Projections

The following revenue projections will not include any potential profits from proprietary trading. ²¹The 2020 Mercator Advisory Group's report indicated that between 10-13% of users opt for paid subscriptions. Due to our survey's promising results, we expect 3% of our users to pay for a Pro subscription and 0.5% to pay for Premium. ²²Large tech companies like YouTube, Instagram, and LinkedIn charge around \$7 per 1000 impressions. We have a far lesser-known brand so will not be able to charge the same rates. However, it should be noted that due to the specificity of our platform's function – adverts will be valuable for things like brokers, trading platforms etc. We plan to charge \$4 (£2.87) per 1000 impressions. We expect freemium users to log in at least twice a month and be subject to an average of one advert while using our application. Using our market size estimation of 5.64m users, we estimate a market value of around £17.3m (based on potential per annum revenue). Using a three-year user uptake estimation of 10, 25, and 40% of our target market, we expect an annual revenue of £1.73m, £4.32m, and £6.92m. Figure 3 in Appendix B shows the exact revenue calculations.

Strategic Defence

The deep learning techniques we utilise are new and have never been applied to financial data before. This puts us in a good position for our initial launch; however, the techniques we use are derived from publicly available research. We cannot guarantee that we will not be copied either by existing or new competitors in the online trading analytics market. Our strategic defence will therefore take three forms: speed to market, strong branding, and good customer relationships. Speed to market should be guaranteed if we act quickly due to the freshness of the research and the novelty of our application. Strong branding will have to be built, using a large amount of our revenue, through marketing campaigns both until the initial launch and beyond. Good customer relationships can be maintained by providing a good service (both in terms of the web application and the effectiveness of our models). We will use best practices for the development and improvements of our web application, including canary releases and Blue/Green testing. These methods combined should reduce the risk of introducing a new software version in production, mitigate downtime, and improve testing. Other methods to ensure strong customer relationships are great customer support, detailed tutorials/documentation, frequent blogs/updates on the stock market, guides on how to trade effectively and manage risk, continuous updates to our features, constant feedback requests and responses from users, developing an online community and maintaining competitive subscription prices.

Appendix A: Bibliography

¹ api-portal.etoro.com. (n.d.). *developer portal*. [online] Available at: <https://api-portal.etoro.com/docs/services/578611076361c80d884cfef1/operations/578650446361c80d884cfef8> [Accessed 24 Mar. 2021]. According to leading trading platform, eToro's, publicly available user data – 79.5% of traders lose money.

² Jung, C., Mueller, H., Pedemonte, S., Plances, S., Thew, O., Bank of England and Fia (2019). Machine learning in UK financial services. [online] www.bankofengland.co.uk, United Kingdom, pp.1–36. Available at: <https://www.bankofengland.co.uk/-/media/boe/files/report/2019/machine-learning-in-uk-financial-services.pdf?la=en&hash=F8CA6EE7A5A9E0CB182F5D568E033F0EB2D21246> [Accessed 20 Feb. 2021].

³ Watt, A. (n.d.). UK Stock Market Statistics. [online] Sharesoc. Available at: <https://www.sharesoc.org/investor-academy/advanced-topics/uk-stock-market-statistics/>.

⁴ Broker Notes (2018). The Modern Trader. [online] brokernotes.co, pp.1–19. Available at: https://brokernotes.co/wp-content/uploads/2017/08/BN-research-report_2018-FINAL.pdf [Accessed 21 Feb. 2021].

⁵ Popper, N. (2020). Robinhood Has Lured Young Traders, Sometimes With Devastating Results. The New York Times. [online] 8 Jul. Available at: <https://www.nytimes.com/2020/07/08/technology/robinhood-risky-trading.html>.

⁶ eToro. (2021). eToro celebrates 20 million registered users. [online] Available at: <https://www.etoro.com/news-and-analysis/etoro-updates/20m-users/#:~:text=We%20can%20now%20say%20it> [Accessed 25 Mar. 2021].

⁷ Osipovich, A. (2020). Individual-Investor Boom Reshapes U.S. Stock Market. Wall Street Journal. [online] 31 Aug. Available at: <https://www.wsj.com/articles/individual-investor-boom-reshapes-u-s-stock-market-11598866200> [Accessed 11 Sep. 2020].

⁸ Markets Media. (2021). US Equity Trading Volume Reaches Record. [online] Available at: <https://www.marketsmedia.com/us-equity-trading-volume-reaches-record/#:~:text=The%20volume%20of%20shares%20traded> [Accessed 28 Feb. 2021].

⁹ TradingView. (n.d.). Free Stock Charts, Stock Quotes and Trade Ideas. [online] Available at: <https://uk.tradingview.com/>.

¹⁰ November 2020, 2nd (2020). TradingView makes UK switch as COVID-19 boosts global users. [online] FinTech Futures. Available at: <https://www.fintechfutures.com/2020/11/tradingview-makes-uk-switch-as-covid-19-boosts-global-users/> [Accessed 24 Mar. 2021].

¹¹ reddit. (2011). r/wallstreetbets. [online] Available at: <https://www.reddit.com/r/wallstreetbets/>.

¹² Kovach, S. (2021). Tesla buys \$1.5 billion in bitcoin and plans to start accepting it as payment for products. [online] CNBC. Available at: <https://www.cnbc.com/2021/02/08/tesla-buys-1point5-billion-in-bitcoin.html> [Accessed 8 Feb. 2021].

¹³ Lechner, M. and Hasani, R., 2020. Learning long-term dependencies in irregularly-sampled time series. Advances in Neural Information Processing Systems, 33.

¹⁴ Neely, C.J., Rapach, D.E., Tu, J. and Zhou, G., 2014. Forecasting the equity risk premium: the role of technical indicators. Management science, 60(7), pp.1772-1791.

¹⁵ Wikipedia. (2021). Quantitative analysis (finance). [online] Available at: [https://en.wikipedia.org/wiki/Quantitative_analysis_\(finance\)](https://en.wikipedia.org/wiki/Quantitative_analysis_(finance)) [Accessed 1 Mar. 2021].

¹⁶ Chen, R.T., Rubanova, Y., Bettencourt, J. and Duvenaud, D., 2018. Neural ordinary differential equations. arXiv preprint arXiv:1806.07366.

¹⁷ Rubanova, Y., Chen, R.T. and Duvenaud, D., 2019. Latent odes for irregularly-sampled time series. arXiv preprint arXiv:1907.03907.

¹⁸ Silva, I., Moody, G., Scott, D.J., Celi, L.A. and Mark, R.G., 2012, September. Predicting in-hospital mortality of icu patients: The physionet/computing in cardiology challenge 2012. In 2012 Computing in Cardiology (pp. 245-248). IEEE.

¹⁹ FCA. (2017). Firms that need authorisation. [online] Available at: <https://www.fca.org.uk/firms/authorisation/when-required>.

²⁰ TradingView. (n.d.). Upgraded Plans & Extra Features. [online] Available at: https://uk.tradingview.com/gopro/?source=header_go_pro_button&feature=start_free_trial [Accessed 8 Mar. 2021].

²¹ Mercator Research (2020). North American PaymentsInsights, U.S. - Subscription Services and Bill Pay: Card Payments Dominate. [online] www.mercatoradvisorygroup.com, United States: Mercator Advisory Group, pp.1–58. Available at: https://www.mercatoradvisorygroup.com/Reports/North-American-PaymentsInsights_-U_S---Subscription-Services-and-Bill-Pay--Card-Payments-Dominate/ [Accessed 10 Mar. 2021].

²² www.webfx.com. (n.d.). CPM Calculator | Free Online CPM Calculator | WebFX. [online] Available at: <https://www.webfx.com/tools/cpm-calculator/>.

Appendix B: Figures

Figure 1.

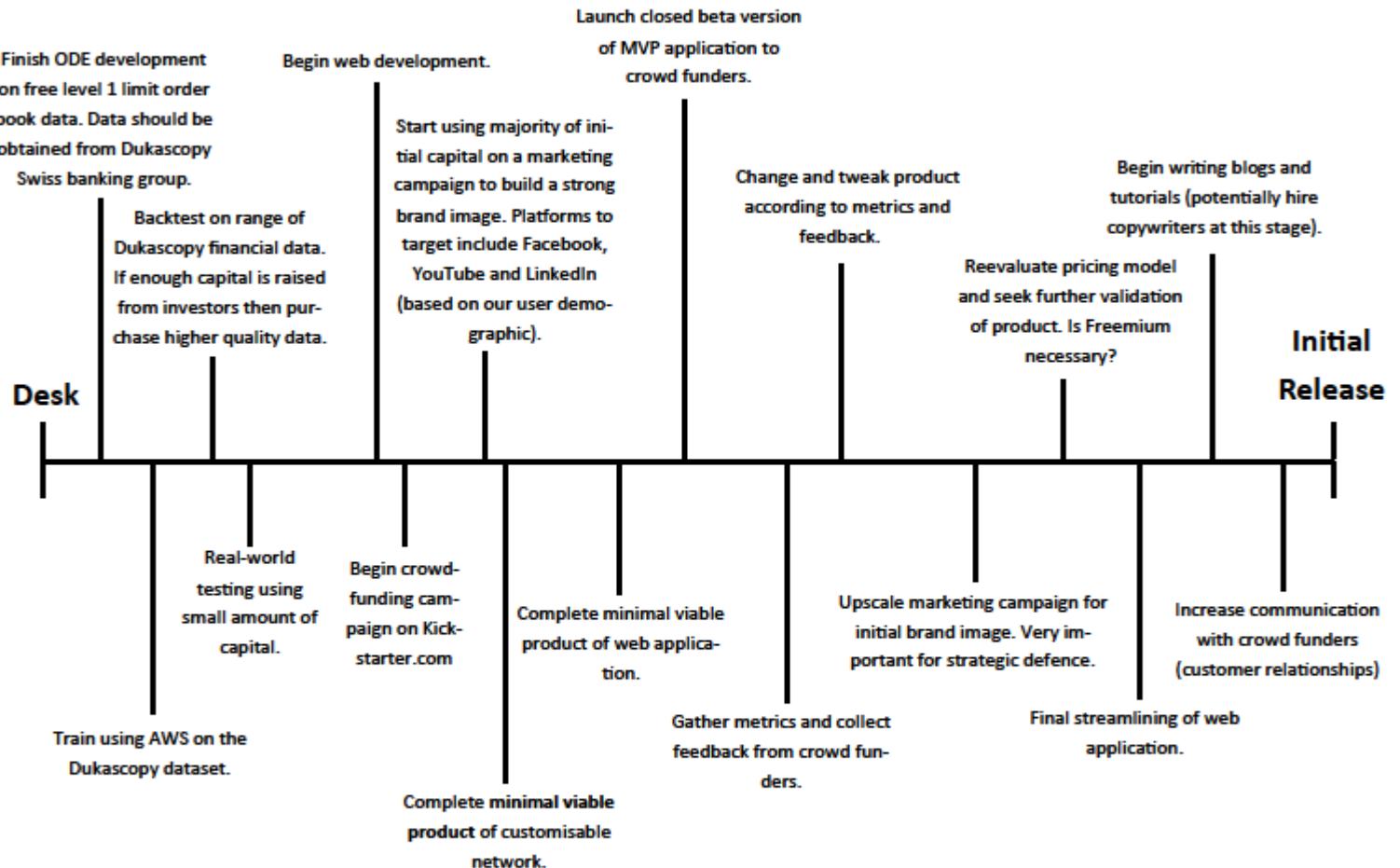


Figure 2.

Average UK trader:

- Male
- 27 year old
- Has a Samsung Galaxy S8
- Uses a Windows computer
- Lives in Manchester
- Interests include football, digital currencies & technology
- Travels economy class
- Drives a basic low-end hatchback (e.g. Vauxhall Corsa)
- Trades cryptocurrencies



Average US trader:

- Male
- 47 year old
- Has an Apple iPhone 6
- Uses a Windows computer
- Lives in New York
- Interests include business & economic news, politics & DIY
- Travels business class
- Drives a full-size sedan (e.g. Chevrolet Impala)
- Trades forex & stocks

Figure 3.

Market size = 5.64m

Premium = 0.5% of 5,640,000 = 28,200 ; 28,200 * £20 * 12months = £6,768,000 per annum

Pro = 3% of 5,640,000 = 169,200 ; 169,200 * £5 * 12months = £10,152,000 per annum

Freemium = 96.5% of 5,640,000 ; 5,442,600 = 5,442,600 * 24 impressions pa / 1000 * £2.87 = £374,886.288p per annum

Total = £6,768,000 + £10,152,000 + £374,886,288p = £17,294,886.288p per annum

First year = 10% of £17,294,886.288p = £1,729,488.6288p

Second year = 25% of £17,294,886.288p = £4,323,721.572p

Third year = 40% of £17,294,886.288p = £6,917,954.5152p