Master’s Project Research

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# General Information

# Existing Master’s Projects

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# Supervisors

### [Pierre Pinson](https://profiles.imperial.ac.uk/p.pinson) – Energy Forecasting, Data Analytics

[Robust Generation Dispatch With Purchase of Renewable Power and Load Predictions](https://ieeexplore.ieee.org/document/10399845)

Robust Generation Dispatch is a way to cope with rising levels of uncertainty considering new greener sources of energy – Pierre first refines the uncertainty data set, building a model that demonstrates how the cost of forecasting energy demand data can be directly related to the quality of that data

### Previous Master’s Projects

* Analysing future renewable energy solutions
* Designing a data crowdsourcing platform
* Regression and classification market platform
* Dynamic network visualisation of destination mapping

### [Sheraz](https://www.linkedin.com/in/sheraz-arif-071a0514/?original_referer=https%3A%2F%2Fwww%2Egoogle%2Ecom%2F&originalSubdomain=uk) - Healthcare

### [Shayan](https://profiles.imperial.ac.uk/s.sharifi/about) – Healthcare, Water and Waste Management

# Interesting Articles

[UN Sustainable Development Goals](https://www.startus-insights.com/innovators-guide/top-startups-scaleups-advancing-the-17-united-nations-sustainable-development-goals-sdgs/)

## New Scientist

[Physics Models for Improving Gen AI](https://www.economist.com/science-and-technology/2024/06/20/how-physics-can-improve-image-generating-ai)

[Suicide Rates as a Result of Social Media](https://www.economist.com/science-and-technology/2024/04/17/what-is-screen-time-doing-to-children)

[Prison Inmates Death Rates](https://www.economist.com/science-and-technology/2024/04/11/the-first-week-after-prison-is-the-deadliest-for-ex-inmates)

[Destruction of Coral Reefs](https://www.economist.com/science-and-technology/2024/05/15/the-great-barrier-reef-is-seeing-unprecedented-coral-bleaching)

## Problems to Tackle

* Only 5% of therapies tested on animals are approved for human use
* Threat of political media misinformation with rising popularity of AI
* Prisons are becoming drastically more overcrowded
* Cement responsible for 7% worldwide carbon emissions

# Key Future Trends

# Initial Ideas (/5)

Modelling projects should aim to be designed around their environment – taking as many key features as possible into account and designing optimisation algorithms to refine designs

* Process refinement for carbon locking (following sequestration) (4)
* Manufacturing with carbon locked marble – development of 3D printing technology? (3)
* Optimisation models for minimising energy consumption on large scale, multi-variate projects (4) – **identify a key case study**
* Predictive genomics modelling software (4)
* Smart thermostat capable of pushing predictive heating models to domestic heating systems (4)
* Impact of social awareness of real-time heat loss when quantified with cost savings for example (3)
* Building identification model (2)
* Generative video game design – create an AI capable of designing simplistic mobile games without code or input media (2)
* Home-based genome sequencing technology (2)
* BIM software that aims to integrate concepts like the 15-minute city (2)
* Bio inspired generative material design software (3)
* Concept car design software – upload sketches and see concept cars imagined takes information on engine size for example and adjusts design (2)
* Robotics project navigating rubble for victims of natural disasters (2)
* Venture capital style model for predicting the public response to new films etc. (3) based on number of test viewings, film critics, production studio, release date wrt. Other films etc.
* General purpose software for predicting the spread of contagious diseases given its source, transmission type, prevalence amongst different strata of the population, resistance to cold, evolution rate etc. (3)
* Smarter real estate app that considers preferences (rather than distance, travel time to workplace for example) (3)
* Smart cities IoT technology that determines when people are passing through (minimise energy consumption through lighting, technology operation etc.) (3)
* Humanising autonomy style image classification software for identifying pedestrians on the roads – pushing advancement towards smart vehicles (3)
* Understanding human traffic – modelling flow of people to manage resources effectively (i.e accessibility to public transport) (4)
* Dynamic pricing models for energy consumption (game theory applications) and waste. Users would be encouraged further to upgrade heat retention properties
* Electrically stimulated biological structures
* Minimizing water consumption in the manufacturing of fashion (3)
* Model the growth of azolla in bodies of water and its impact on the ecosystem and satellite imaging to identify early onset spreading, design robot system for extracting azolla (3)
* Data collection platform for modelling environmental changes in place of satellite navigation (i.e drone-based data collection)
* Scaled down 5 axis CNC milling machine
* Automated tractor design for un-manned harvesting

## Ideas Found from Internships

* Develop heat pump digital twin software to simulate energy loss across the home and appropriately size heat pumps for the space (look at Adia)
* Generative software that takes knowledge of thermal storage values for furniture, scans an environment and proposes changes
* Simulate the heat pumps themselves to predict COP values etc.
* Design predictive maintenance software to inform repairs and design refinements for heat pumps
* Create a network/hub for start-up founders to connect with one another
* Design an optimisation-based software for determining the best positions of electrodes along the face of a complex body
* Extended capacitive field motion control

# Venture Programmes

The idea is to look at existing start-ups backed by some of the biggest investment partners to see what ideas looks valuable now. In theory, these companies will be pushing the boundaries of innovation.

## Y-Combinator Start Ups (2024)

## Sequioa Capital Start-Ups

# Smart Cities Redesign

[Smart Cities and Energy](https://energy.ec.europa.eu/topics/research-and-technology/energy-and-smart-cities_en)

[Greatest Sources of Energy Loss in Cities](https://www.tomorrow.city/where-is-most-electricity-wasted-in-cities/)

* Public lighting is responsible for 2% of a country’s energy consumption per year
* Transport is responsible for 25-38% of a country’s energy consumption per year
* Smart energy grids and decentralised energy

[Smart Cities Under Climate Change - A Critical Review](https://www.sciencedirect.com/science/article/pii/S2210670721005540#sec0024)

## Further Ideas (/5)

* With a known environment, using generative software to design city infrastructure (water systems, microgrid designs etc.)

# Sustainability

1. Energy
2. Agriculture
3. Fashion
4. Food Retail
5. Transport
6. Construction

## Agriculture

* General purpose modelling software that takes environmental factors and a known environment to demonstrate the expansion/development of viruses, diseases and pests, clearly outlining the effect on yield
* Shared resources model for crop yields
* Dynamic pricing model for crop yields – cheaper for locals to prevent carbon consumption on shipping and encourage consumption of otherwise
* Optimisation models for selecting most appropriate crops for the land
* Game theory model for water allocation in drought-prone areas

[Climate Change Impact on Crop Yields](https://www.google.com/search?q=climate+change+impact+on+agriculture&sca_esv=a68519ea8e0c1423&biw=1280&bih=587&tbm=vid&sxsrf=ADLYWIIDD1mUtXIxefUu55hcSwgGAAq3Sw%3A1728234051607&ei=Q8ICZ4rgJO26hbIPhMa5gAQ&ved=0ahUKEwjKjfDFnfqIAxVtXUEAHQRjDkAQ4dUDCA0&uact=5&oq=climate+change+impact+on+agriculture&gs_lp=Eg1nd3Mtd2l6LXZpZGVvGgIYAyIkY2xpbWF0ZSBjaGFuZ2UgaW1wYWN0IG9uIGFncmljdWx0dXJlMgUQABiABDIFEAAYgAQyBRAAGIAEMgsQABiABBiGAxiKBTILEAAYgAQYhgMYigUyCBAAGIAEGKIEMggQABiABBiiBDIIEAAYgAQYogQyCBAAGKIEGIkFSOkzUL8DWPAycAV4AJABAJgBsAGgAb8ZqgEEMzEuNrgBA8gBAPgBAZgCKqACkxyoAgrCAgYQABgWGB7CAgcQIxgnGOoCwgIEECMYJ8ICCxAAGIAEGJECGIoFwgILEAAYgAQYsQMYgwHCAhAQABiABBixAxiDARiKBRgKwgIOEAAYgAQYsQMYgwEYigXCAgoQABiABBhDGIoFwgIIEAAYgAQYsQPCAg0QABiABBixAxhDGIoFwgIQEAAYgAQYsQMYQxiDARiKBZgDDYgGAZIHBDMzLjmgB43uAQ&sclient=gws-wiz-video#fpstate=ive&vld=cid:e02dcd16,vid:-NZIvvhGlR0,st:0)

# Azolla Detection and Mitigation UK Water

<https://sgmatters.org.uk/NEWSLETTERS/AZOLLACONTROL.pdf>

North American weevil is the most effective way to tackle the azolla, but we have no means to detect and predict spread

# Prisons