CS230 Project Proposal

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Q1. We are investigating the problem of child starvation and malnutrition because they lead to physical and mental stunting. In the information age, stunting will inhibit industrialization of developing countries (11). Child malnutrition has been linked to a shortage of food groups containing "iron, iodine, vitamin A and zinc" (2). If we can predict a country's food balance, we can then predict and prevent child starvation and stunting.

Q3. The Food and Agriculture Organization of the United Nations (FAO) provides myriad food and agriculture data for around 250 countries. We will use the Food Balance, Food Supply, and Detailed Trade Matrix datasets (Figure 1). Food Balance is combination of supply, trade, livestock feed, transportation losses, etc. UNICEF provides an accumulation of statistics on child wasting and stunting for the same countries as those described in the FAO datasets. This dataset begins in 1985 and is missing statistics for some countries and years.

	Area Code	Area	Item Code	Item	Element Code	Element	Year Code	Year	Unit	Value	Flag
1900000	118	Kuwait	2602	Onions	645	Food supply quantity (kg/capita/yr)	1962	1962	kg	16.03	Fc
1900001	118	Kuwait	2602	Onions	645	Food supply quantity (kg/capita/yr)	1963	1963	kg	14.06	Fc
1900002	118	Kuwait	2602	Onions	645	Food supply quantity (kg/capita/yr)	1964	1964	kg	21.02	Fc
1900003	118	Kuwait	2602	Onions	645	Food supply quantity (kg/capita/yr)	1965	1965	kg	21.62	Fc
1900004	118	Kuwait	2602	Onions	645	Food supply quantity (kg/capita/yr)	1966	1966	kg	18.12	Fc

Figure 1: Example data (FAO)

Q2. Our datasets only provide country-level data. We would prefer data on a smaller scale. The FAO datasets pre-date the UNICEF malnutrition data by 20 years. The UNICEF malnutrition data is missing for some countries and years. UNICEF and FAO are fundamentally different datasets, accumulated from different sources. For training, we need to determine how far out food balance affects malnutrition.

Q4. We will train an RNN to predict a country's food balance (for a specific food group), given supply and trade some number of years prior. We believe an RNN is appropriate given the time-series aspect (Figure 2).

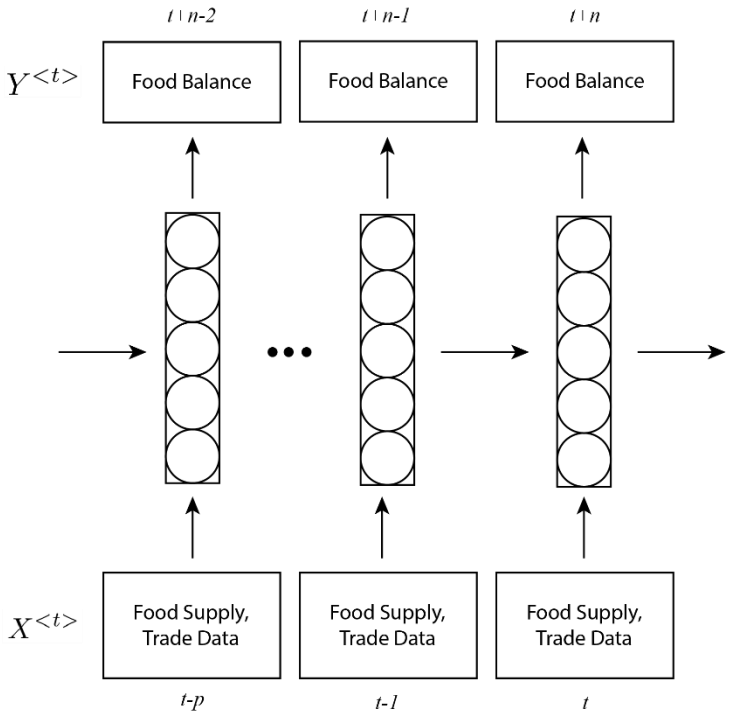

Figure 2: Proposed RNN architecture

Next, we will train an NN to predict child malnutrition from the Food Balance. Combining these two models, we will make predictions of child malnutrition from food supply and trade.

Q5. Existing work has been done with multivariate regression (3) for predicting malnutrition. Reference 12 uses NARNNs to predict crop yield. Additionally, it uses a multilayer perceptron to describe spatial correlations between plantation and crop yield. Reference 11 uses CNNs and LSTMs to predict crop yields. Both publications solve slightly different problems from ours- we are predicting food balance, not crop yields. If predications from our architecture are unsatisfactory, we will consider using a LSTM or NARNN.

Q6. A prediction is considered correct if it is *within 10% of example output*. We expect satisfactory results from our first model because food balance is based largely upon food supply and trade. The second model is more difficult to predict. However, previous studies (3) show a correlation (~70%) between toddler stunting and family descriptors. We expect similar correlations with food availability. We will graph the number of correct results, as well as our cost function. The trends in these graphs will provide a qualitative measure of our model's success. If we are not able to reliably improve our model, we will focus effort on just the countries with the highest malnutrition among children, since error is likely to be introduced during the collaborative filtering of the missing UNICEF data.

Sources:

1. http://www.fao.org/faostat/en/#data/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1180662/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5533133/pdf/zgha-10-1339981.pdf
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5. http://sciencenordic.com/predicting-future-food-crises
6. https://www.agmrc.org/renewable-energy/renewable-energy/can-we-meet-the-worlds-growing-demand-for-food
7. https://www.tandfonline.com/doi/full/10.1080/21553769.2016.1174958
8. https://academic.oup.com/jn/article-abstract/121/3/408/4754597
9. https://data.unicef.org/resources/dataset/malnutrition-data/
10. https://data.unicef.org/resources/dataset/infant-young-child-feeding/
11. https://cs.stanford.edu/~jiaxuan/files/Jiaxuan_AAAI17.pdf
12. https://www.hindawi.com/journals/mpe/2014/857865/

***** Switched order of Q2 and Q3 because it reads better. *****