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Automatic classification of farms and traders in the pig production chain

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Abstract

The trade in live pigs is an essential risk factor in the spread of animal diseases. Traders play a key role in the trade network, as they are logistics hubs and responsible for large animal movements. In order to implement targeted control measures in case of a disease outbreak, it is hence strongly advisable to use information about the holding type in the pig production chain. However, in many datasets the types of the producing farms or the fact whether the agent is a trader are unknown.

In this paper we introduce two indices that can be used to identify the position of a producing farm in the pig production chain and more importantly, identify traders. This was realized partially through a novel dynamic programming algorithm. Analyzing the pig trade network in Germany from 2005 to 2007, we demonstrate that our algorithm is very sensitive in detecting traders. Since the methodology can easily be applied to trade networks in other countries with similar infrastructure and legislation, we anticipate its use for augmenting the datasets in further network analyses and targeting control measures. For further usage, we have developed an R package which can be found in the supplementary material to this manuscript.

Keywords: German pork production, Animal movement, Traders, Complex network, Network Analysis, Epidemiology

1. Introduction

The trade in live pigs is an essential risk factor in the spread of animal diseases. This is particularly true for the dissemination of the classical swine fever (Büttner et al., 2013; Fèvre et al., 2006; Fritzemeier, 2000; Green et al., 2006; Ribbens et al., 2011) and also non-notifiable diseases like salmonellosis (Lo Fo Wong et al., 2004) or brucellosis (Daz Aparicio, 2013). In particular in Germany, pork production is a very important economic factor (FMoFaA, 2017). Trade takes place mainly between different agents that contribute to the production chain. These include all different kinds of producing farms such as breeding/nursery/fattening farms, their mixtures,

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