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An adapted point frame sampling to estimate the crop acreage at county level on the North China Plain

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Image classification including sub pixel analysis are often used to estimate directly the crop acreage, while ground data collected during field surveys play a secondary role. This pixel counting approach translating actually the ratio between the number of the pixels classified into a specific crop and the total number of the classified pixels, can lead to a biased estimation when it is used as estimator. Instead remote sensing images can be combined with ground data collection in a regression estimators approach for example to estimate the crop acreage. The methodology that we performed in our study is derived from the LUCAS statistical survey developed by the European Commission. The remote sensing information is used at two levels. First the satellite images were used to perform a cost-efficient stratification from which no-agricultural areas are excluded from ground survey. In a later stage the classification of satellite images was included as an estimator in regression analysis. The method started with a two-phase sampling plan. In the first phase, a stratification was carried out using two grids of 4 km were laid on remote sensing images (SPOT5 and images provided by Google Earth). 267 points fall within the boundary of Mengcheng county. The stratification were operated with 5 strata including the agriculture, non–agriculture, permanent vegetation, thematic and geographical doubts. 100 points were randomly selected within the stratum agriculture from which 83 were visited within 2 successive surveys using GPS. The described method in this study differ from the original point segment survey on the attributes of the point segments. Here each point was conferred with a percentage of crops by surveying the field where the point is located. The statistics of the ground surveys are derived. In the second stage, classification of high resolution images provided by Landsat TM and SPOT HRS sensor was carried out. Finally the area fractions of crops (maize and soya beans) are derived from ground survey is regressed with those from the classification. The results showed that the integration of classification as an auxiliary estimator can reduce the variance of these estimates by a factor of 2.6.

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利用自适应点采样框架估算华北各县作物种植面积

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影像分类（包括亚像元分析等）经常被用于直接估算作物种植面积，而地面调查期间所获取的地面数据多作为分类的辅助信息。这种通过像元数量来估算作物面积实际上是将特定作物的像元数据在参与分类的像元总数的比例转换为作物种植面积。这种估算方法经常导致较大的估算误差。另一种方法是将遥感影像与地面观测数据相结合，建立作物种植面积回归模型。在我们的研究中，这种方法主要是依据欧盟委员会的LUCAS统计调查结果实现的。研究过程中主要在两个层次上使用了遥感数据。一方面遥感数据作为一种的经济有效的分层手段，通过地面调查进行非耕地去除，另一方面，遥感数据的分类结果被用于面积估算的回归分析。本方法中的采样主要包括两个层次，第一层次是分层，先利用4km间隔的格网对遥感影像（主要包括SPOT及其他由Google earth提供的影像）进行分层处理，其中蒙城县辖区内包含了267个采样点。分区处理主要分为农业区、非农业区、永久性植被、专题和不确定区域等5种类型。在农业区中随机选取100个采样点，并利用GPS对其中83个样点进行了两次地面调查。本研究所用的方法在样点的调查上与以往的地面调查有一定的差别，主要体现在对样点属性上。通过对每一样点的调查，获取该样点每种作物的种植比例，并赋予该样点相应的属性。完成所有样点的调查之后统计获得了地面调查的统计信息。第二层次是分类，主要利用Landsat TM、SPOT5等高分辨率数据进行分类。最终将统计得到的作物种植比例（包括玉米和大豆）与分类结果进行回归分析。研究结果表明将分类结果作为辅助估算手段的方法使样点上的作物种植面积估算结果的方差缩小了2.6倍。

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