README FOR PYTHON IMPLEMENTATION OF FPMLE and FPMLE^{++}

(`nlmfe` package)

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This folder contains Python code for algorithms 1 (FPMLE) and 2 (FPMLE^{++}) developed in Mugnier and Wang (2022, WP).

FPMLE and FPMLE^{++} are implemented for N-by-T data sets in the file *TwoWayFPMLE.py*.

Implementation covers the following models: unit $i \in \{1, \dots, N\}$ at time $t \in \{1, \dots, T\}$ with characteristics $x_{it} \in R^K$ chooses outcome $y_{it} \in \mathcal{Y}$ such that

$$\Pr(y_{it} = y \mid x_{i1}, \dots, x_{it}, \alpha_i, \xi_t, \beta_i) = g(y; x_{it}'\beta_i + \alpha_i + \xi_t).$$

Model	$\mathcal{Y}$	Link function g
Binary Probit	$\{0,1\}$	$g(y; x_{it}'\beta_i + \alpha_i + \xi_t) = I(y=0) \times [1 - \Phi(x_{it}'\beta_i + \alpha_i + \xi_t)] + I(y=1) \times \Phi(x_{it}'\beta_i + \alpha_i + \xi_t)$ with Φ the cumulative distribution function (cdf) of the standard normal.
Binary Logit	$\{0,1\}$	$g(y; x_{it}'\beta_i + \alpha_i + \xi_t) = I(y=0) \times [1 - \Lambda(x_{it}'\beta_i + \alpha_i + \xi_t)] + I(y=1) \times \Lambda(x_{it}'\beta_i + \alpha_i + \xi_t)$ with $\Lambda(z) = 1/(1+\exp(-z))$ the cdf of the standard logistic.
Poisson Count	$\{0,1,2, \dots\}$	$g(y; x_{it}'\beta_i + \alpha_i + \xi_t) = \frac{\exp(-\exp(x_{it}'\beta_i + \alpha_i + \xi_t)) \exp\big(y(x_{it}'\beta_i + \alpha_i + \xi_t)\big)}{y!}$

For a user-specified unit $i^\star \in \{1, \dots, N\}$, $\alpha_{i^\star} = 0$. For a user-specified set of indices $\mathcal{K} \subset \{1, \dots, K\}$, $\beta_{i,k} \equiv \beta_k, \forall (k, \mathrm{i}) \in \mathcal{K} \times \{1, \dots, N\}$. Default is $\mathcal{K} = \{all\ coordinates\}$, i.e., homogeneous slope coefficient $\beta_i \equiv \beta$.

The file *BiasCorrections.py* contains functions for performing the analytical bias corrections developed in Fernandez-Val and Weidner (2016).

The file *PanelPreProcess.py* contains functions for pre-formating unbalanced panel data under a « missing at random » assumption.

The file *func.py* contains various useful functions.

All routines are illustrated by a simple Monte Carlo simulation and an application to trade data in the Jupyer notebook *nlmfe_in_practice.ipynb*.

References :

Fernandez-Val, I. and M. Weidner (2016): « Individual and time effects in nonlinear panel models with large N, T », *Journal of Econometrics*, 192(1), 291-312,

Mugnier, M. and A. Wang (2022): « Identification and (Fast) Estimation of Large Nonlinear Panel Models with Two-Way Fixed Effects », SSRN.