**Supplementary materials**

**Computer Aided Detection Model Based on Optimized Deep LSTM Ensemble Model and the Fusion of Multimodal Time Series Data**

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**Table S1:** Features description

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| NACC Categories | Variable Name | Variable Type | Descriptions |
| AD stage | CDRGLOB | Ordinal | Global CDR score, which is used to define the AD progression stages |
| Time interval | TI | Continuous | Derived by authors; Time interval between two consecutive visits |
| A1 Subject Demographics | AGE | Continuous | Derived by authors |
| SEX | Nominal | Subject’s sex |
| RACE | Nominal | Subject’s race |
| PRIMLANG | Nominal | Primary language |
| EDUC | Ordinal | Years of education |
| NACCLIVS | Nominal | Living situation |
| INDEPEND | Ordinal | Level of independence |
| RESIDENC | Nominal | Type of residence |
| MARISTAT | Nominal | Marital status |
| HANDED | Nominal | Is the subject left- or right-handed? |
| TOBAC30 | Nominal | Smoked cigarettes in last 30 days |
| A5 Subject Health History | TOBAC100 | Nominal | Smoked more than 100 cigarettes in life |
| SMOKYRS | Ordinal | Total years smoked cigarettes |
| CVHATT | Ordinal | Heart attack/cardiac arrest |
| CVAFIB | Ordinal | Atrial fibrillation |
| CVANGIO | Ordinal | Angioplasty/endarterectomy/stent |
| CVBYPASS | Ordinal | Cardiac bypass procedure |
| CVPACE | Ordinal | Pacemaker |
| CVCHF | Ordinal | Congestive heart failure |
| CVOTHR | Ordinal | Other cardiovascular disease |
| CBSTROKE | Ordinal | Stroke |
| CBTIA | Ordinal | Transient ischemic attack (TIA) |
| SEIZURES | Ordinal | Seizures |
| DIABETES | Ordinal | Diabetes |
| TOBAC100 | Nominal | Smoked more than 100 cigarettes in life |
| DIABTYPE |  | If Recent/active or Remote/inactive Original UDS question v3 diabetes, which type? |
| HYPERTEN | Ordinal | Hypertension |
| HYPERCHO | Ordinal | Hypercholesterolemia |
| B12DEF | Ordinal | Vitamin B12 deficiency |
| THYROID | Ordinal | Thyroid disease |
| ALCOHOL | Ordinal | Alcohol abuse — clinically significant impairment occurring over a 12-month period manifested in one of the following areas: work, driving, legal, or social Numeric longitudinal |
|  | DEP2YRS | Nominal | Active depression in the last two years |
| DEPOTHR | Nominal | Depression episodes more than two years ago |
| PSYCDIS | Ordinal | Other psychiatric disorder |
| HEIGHT | Continuous | Subject’s height (inches) |
| B1 Physical | WEIGHT | Continuous | Subject’s weight (lbs) |
| BPSYS | Continuous | Subject blood pressure (sitting), systolic |
| BPDIAS | Continuous | Subject blood pressure (sitting), diastolic |
| HRATE | Continuous | Subject resting heart rate (pulse) |
| VISION | Nominal | Without corrective lenses, is the subject’s vision functionally normal? |
| HEARING | Nominal | Without a hearing aid(s), is the subject’s hearing functionally normal? |
| B4 Global Staging Clinical Dementia Rating (CDR) | MEMORY | Ordinal | Memory |
| ORIENT | Ordinal | Orientation |
| JUDGMENT | Ordinal | Judgment and problem-solving |
| COMMUN | Ordinal | Community affairs |
| HOMEHOBB | Ordinal | Home and hobbies |
| PERSCARE | Ordinal | Personal care |
| CDRSUM | Ordinal | Standard CDR sum of boxes |
| CDRLANG | Ordinal | Language |
| COMPORT | Ordinal | Behavior, comportment, and personality |
| NOGDS | Nominal | Is the subject able to complete the GDS, based on the clinician’s best judgment? |
| **B6 Geriatric Depression Scale (GDS)** | SATIS | Nominal | Are you basically satisfied with your life? |
| DROPACT | Nominal | Have you dropped many of your activities and interests? |
| EMPTY | Nominal | Do you feel that your life is empty? |
| BORED | Nominal | Do you often get bored? |
| SPIRITS | Nominal | Are you in good spirits most of the time? |
| AFRAID | Nominal | Are you afraid that something bad is going to happen to you? |
| HAPPY | Nominal | Do you feel happy most of the time? |
| HELPLESS | Nominal | Do you often feel helpless? |
| STAYHOME | Nominal | Do you prefer to stay at home, rather than going out and doing new things? |
| MEMPROB | Nominal | Do you feel you have more problems with memory than most? |
| WONDRFUL | Nominal | Do you think it is wonderful to be alive now? |
| WRTHLESS | Nominal | Do you feel pretty worthless the way you are now? |
| ENERGY | Nominal | Do you feel full of energy? |
| HOPELESS | Nominal | Do you feel that your situation is hopeless? |
| BETTER | Nominal | Do you think that most people are better off than you are? |
| NACCGDS | Ordinal | Total GDS Score |
| **B7 Functional Activities Questionnaire (FAQ)** | BILLS | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Writing checks, paying bills, or balancing a checkbook |
| TAXES | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Assembling tax records, business affairs, or other paper |
| SHOPPING | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Shopping alone for clothes, household necessities, or groceries |
| GAMES | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Playing a game of skill such as bridge or chess, working on a hobby |
| STOVE | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Heating water, making a |
|  | MEALPREP | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Preparing a balanced meal |
| EVENTS | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Keeping track of current events |
| PAYATTN | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Paying attention to and understanding a TV program, book, or magazine |
| REMDATES | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Remembering appointments, family occasions, holidays, medications |
| TRAVEL | Ordinal | In the past four weeks, did the subject have any difficulty or need help with: Traveling out of the neighborhood, driving, or arranging to take public transportation |
|  | NACCMMSE | Ordinal | Total Mini-Mental State Examination (MMSE) score (using D-L-R-O-W) |